March 1984 Volume 2 $2.50

softalk

for the IBM Personal Computer

IBM vs. CORONA

THE ANALYTICAL ENGINE

DEBUT: BASICALLY SPEAKING

WHY APL?

TELEGAMING

It Reads, Writes and It Paints in 3-D, Keeps and Talks to

It's called "OPEN ACCESS," and it's the result of 60 man-years of effort to create a truly do-it-all, super-program—one that can perform virtually every task you're ever likely to encounter.

The beauty of it is, all that capability resides on a single program. You don't have to re-enter data. Or spend time trying to get unmatched programs to work together.

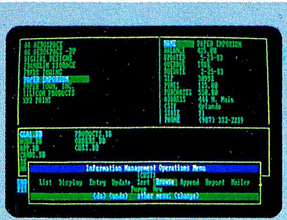
OPEN ACCESS takes its name from the source of its power—a relational data-base manager that gives you access to more data in more ways than any comparable software.

OPEN ACCESS includes an electronic spreadsheet, 3-D graphics, word processor, appointment scheduler and telecommunications module—all revolving around the powerful information manager.

SPI
SOFTWARE PRODUCTS INTERNA
O·P·E·N ACCESS
An Integrated System
USER MANUAL
Information Management
Spread Sheet
Graphics
Word Processing
Communication
Time Management

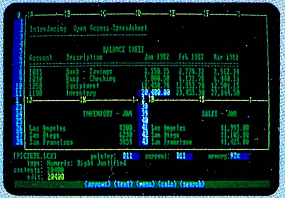
See us at COMDEX, Booth W648

1


Information Management Operations Menu
List Display Entry Update Sort Browse Append Report Mailer

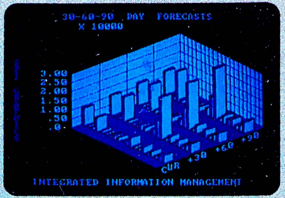
INFORMATION MANAGEMENT—THE MASTERMIND. This advanced data-base manager stores and retrieves multiple files quickly, easily and reliably. What's more, it shares all information with the other programs, so you never have to re-enter the same data twice.

2


Introducing Open Access Spreadsheet
BALANCE SHEET
Account Description Jan 1982 Feb 1982 Mar 1982
INVENTORY - JAN
SALES - JAN
Los Angeles
San Diego
San Francisco

ELECTRONIC SPREADSHEET—NUMBER CRUNCHING AND GOAL SEEKING. It helps you produce forecasts, cost estimates and "break-even" points—in seconds, instead of hours or days. Best of all, it allows "goal seeking." Ask, for example, "What sales must I have the rest of the year to net $1 million?," and OPEN ACCESS will figure it out!

3


30-60-90 DAY FORECASTS
X 10000
3.00
2.50
2.00
1.50
1.00
.50
.0
CUR
+30
+60
+90
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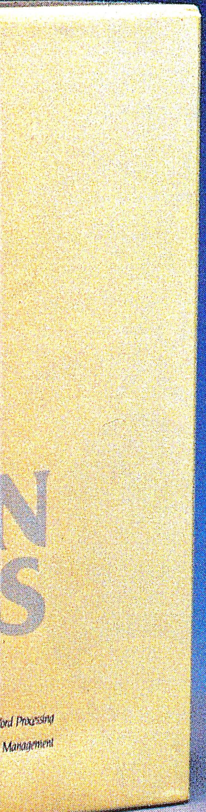
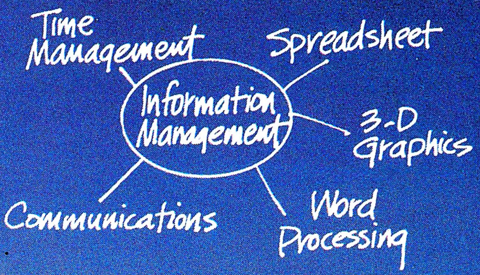


Because they do not have a dedicated relational data-base manager that can quickly direct massive amounts of data, other programs simply can't do what OPEN ACCESS can. Some don't have a communications program, others no dedicated word processor. None have a time management program.



There's just one conclusion: At $595,* OPEN ACCESS can do more for you than any other comparable business program on the market. Bar none. But the only way for you to be convinced is for you to see OPEN ACCESS work its magic on your work load. So call your local software dealer today, or call us at SPI, at 619-450-1526.

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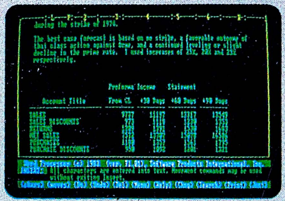
4



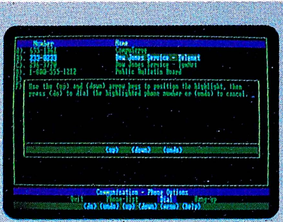
during the strike of 1976.

Proforma Income Statement

Account Title From GL +30 Days +60 Days +90 Days

WORD PROCESSING—EDITOR EXTRAORDINAIRE! Superior word processors make it easy to correct typos, change words, shuffle paragraphs and format documents. This is one of that breed. Use it to write efficient memos, letters, proposals and reports.

5



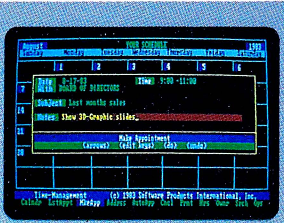
Use the (up) and (down) arrow keys to position the highlight, then press (do) to dial the highlighted phone number or (undo) to cancel.

(up) (down) (undo)

Communication - Phone Options

TELECOMMUNICATIONS—YOUR LINK WITH THE WORLD. This program gives you access to virtually any other computer system in the world. Not only can you transmit and receive reports from your colleagues, you can also subscribe to special data banks that know everything from GM's stock price to the relative humidity in Genoa. Now that's power!

6



YOUR SCHEDULE 1983

Time 9:00 -11:00

Subject Last months sales

Notes: Show 3D-Graphic slides

Make Appointment

Time-Management (c) 1983 Software Products International, Inc.

TIME MANAGEMENT—CONSERVING YOUR MOST PRECIOUS RESOURCE. This module helps you keep track of all your appointments, hour by hour, day in and day out. It alerts you to standing obligations, automatically coordinates meeting times with other busy professionals, and lists all your associates on a Rolodex™-like file.

softalk

for the IBM Personal Computer

Features

IBM Clamps Down on (Some) Compatibles

After more than a year of official silence, IBM filed copyright infringement suits against at least a couple of the PC-compatible makers.

Kevin Goldstein 26

The Impact of Betamax on Copyright Law

IBM's case was founded on the presumption that its ROM BIOS is protected by copyright. But is it, in fact? And if it is, what amount of copying—by whom—might a court of law condone?

Herbert Swartz 32

The Basic/Assembly Line:
Machine-Language Sorting from Basic

Bubbles are nifty but the Shell macht schnell.

Howard Glosser 52

Telegaming

What to do with your modem on a quiet night at home.

Patricia Fitzgibbons 88

Column Debut: Basically Speaking

A gentle introduction to the pleasures of programming in BASIC.

John Dickinson 98

APL: A Pretty strange-looking Language

Two systems reviewed—and an overview of APL itself.

Bruce Filbeck 107

The Analytical Engine

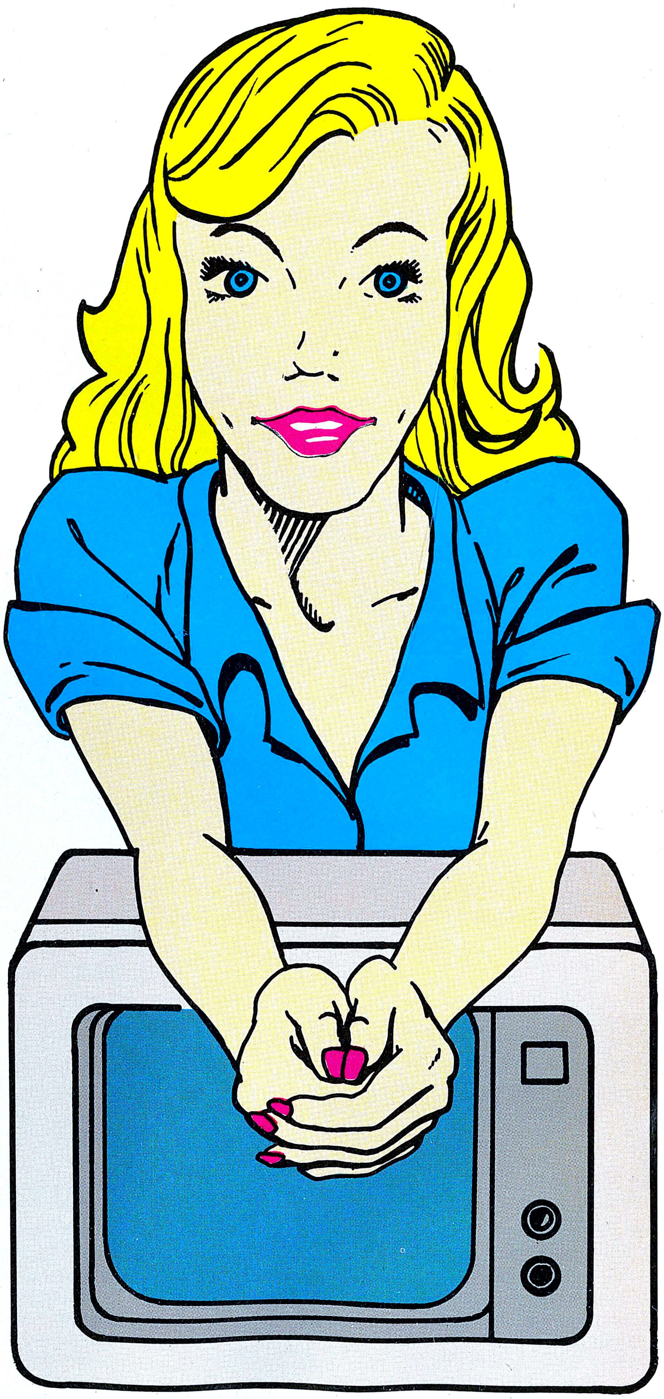
The first of many features on scientific and engineering uses for the PC.

Ed Bogucz 112

A Tale of Two Cs

One low C one, high: reviews of the Small-c:PC and DeSmet C compilers.

Rex Jaeschke 139



Guest Contest: Win a PCjr!
Photon Software needs a name for their new product. There's a Junior in it for you (other prizes, too)..................152

Columns

Beginners' Corner, by Kathy Talley-Jones 40
The C Spot, by Rex Jaeschke 82
Comm Lines, by Kevin Goldstein 20
Micro Finance, by Ken Landis 147
Pascal from Begin to End, by Bruce Webster and Deirdre Wendt 155
The Printed Word, by John Dickinson 121
The Processed Word, by Terry Tinsley Datz and F. Lloyd Datz 74
Questions and Answers, by Nancy Andrews 16
The Right to Assemble, by Ray Duncan 184
System Notebook, by Alan Boyd 65

Departments

Bestsellers 191
Classified Advertising 12
Contest 4
Crosstalk 8
Marketalk News 161
Marketalk Reviews 130
Newspeak 173
Tradetalk 48

Cover photography by Kevin McKeon and Tim Durr.

Index to Advertisers

Access Micro	183
Advanced Business Computing	71
Alpha Delta Communications	10
The Alternate Key	68
Ann Arbor	Cover 3
AST Research	6-7
ATI Training Power	17
Awareco	62
Basic Business Software	130
A.G. Becker	177
Beck Manufacturing	145
Best Programs	114,166
Bizcomp	24-25
Blaise Computing	186
The Book Company	156
Borland International	46,117
The Boston Company	157
Bourbaki, Inc.	131
BPI Systems	142
The Brady Company	35,36-37,38
Broderbund Software	135
Bullish Investment Software	84
Business Solutions	103
Cdex	111
Tom Ciulik	144
Computer Control Systems	126
Computer Creations	137
Computer Inventory Control	64
Concentric Data Systems	171
Consumers Software	146
Contemporary ComputerWear	123
Context Management	125
Continental Software	29,81
Control Data	96-97
Data Base Decisions	101
Data Technology	49
Decision Support Software	93
Earth Data Corporation	151
Egghead Software	83
Ensign Software	136
Europro	132
Falcon Safety Products	50
Falcon Technology	150
FMJ	100
FriendlySoft	5
Gourmet Software	66
HammerLab	8
Harvard Associates	161
Hauppauge Computer Works	138
Hayes Microcomputer Products	148-149
Healthware	165
H&E Computronics	23
Hercules Computer Technology	21
Howard Software Services	Cover 4
Human Systems Dynamics	180
IBM Personal Computer	44-45
Individual Software	15
Infocom	60-61
Integral Quality	63
Kamerman Labs	188
Laboratory Microsystems	48
Lewis Lee	42
Lifetree Software	122
Living Videotext	120
Marc Software	41
MA Systems	190
Maynard Electronics	95
Megahaus	33
Microcompatibles	65
Microcomputer Accessories	162
Micro Decision Systems	77
Micro Design International	14
Microrim	168-169
Micro-Software Developers	140
Micro Storehouse	185
Micro-tax	172
Multi-Tech Systems	9
Muse	158
Nebs Computer Forms	22
Peter Norton	70
Omni Software Systems	164
Opt-Tech Data Processing	124
Origin Systems	59
Pacific Infotech	174
Palantir Software	129
Panamax	170
PC-Demo	191
PC+ Products	87
PCsoftware	141
Pegasus	75,127
Personal Computer Userfest	118
Photon Software	102
PICOtronics	153
Plum Hall	85
Polytron	108
Popcom	72-73
Prelude Computer Corporation	163
Professional Software	11
Quadram Corporation	51
Qubie	54
Rems	40
Rixon	154
Rocky Mountain Software Systems	43,67
Rogue River Software	80
Satellite Software International	19
Satori Software	47
Security Microsystems Consultants	179
Select Information Systems	160
Siechert & Wood Technical Publications	184
Smith Micro	167
SoftLogic Solutions	178
Softstyle	139
Softalk	30,119,176
Software Link	76
Software 128	143
Software Products International	Cover 2-1
Soft Wares and Technology	110
SolveWare	105
Street Electronics	147
Strictly Soft Ware	109
SubLogic Corporation	133
Sundex Software	79
Sweet Gum	78
Tailored Data	86
1040Plan	69
3M Company	90
Transtar	134
Unlimited Computer Programming	182
Virtual Combinatics	181
Vision Information Products	175
Walonick Associates	192
XOR	31

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Regional Editors	Hartley G. Lesser Roe Adams III
West Coast Sales	Mike Antich Softalk 7250 Laurel Canyon Boulevard Box 7040 North Hollywood CA 91605 (818) 980-5074
East Coast Sales	Ian Ross Paul McGinnis Advertising Sales 690 Broadway Massapequa, NY 11758 (212) 490-1021
Midwest and Rocky Mountain Sales	Ted Rickard Kevin Sullivan Christopher Kaspar Market/Media Associates 435 Locust Road Wilmette, IL 60091 (312) 251-2541

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ANNAPURNA SOFTWARE

THE ABOMINABLE CONTEST

High in the Himalayas, far from the distractions of twentieth-century life, Annapurna Software has established a quality-control center guaranteed to be free of dust and grime. The company recently shipped a crate containing its new game cartridge for the PC*jr*—*Yowling Yeti*, a blatant *Mouser* ripoff.

The five monks that the company employs have been excited about the prospect of testing these cartridges—each monk is a *Mouser* maniac. They all believe the game helps them achieve satori. They have agreed to divide the cartridges evenly among themselves so that no one monk will have a better chance of achieving enlightenment than the others.

Unfortunately, one worried monk awoke in the middle of the night, fearing that he wouldn't get his rightful share of cartridges. He went out to the stockroom and divided the cartridges into five equal shares. After he had done this, there was one cartridge left over, so he gave it to a passing little tramp. After hiding his share, he regrouped the remaining cartridges into one pile and went back to sleep.

Later, a second monk awoke. Possessed by the same fears that drove the first monk to his act of infamy, he also sneaked into the storeroom and wound up with one extra cartridge after dividing the pile into five. He gave the extra cartridge to the same little tramp, hid his own share, and went back to sleep.

As the night wore on, each of the remaining three monks awoke and repeated the same procedure with the same results.

As dawn broke over the jagged peaks, the monks successfully divided the remaining cartridges equally among themselves and began following the *Yowling Yeti* path to nirvana.

All you need do to win $100 worth of software is tell us what the smallest possible number of cartridges in the original shipment was. Send your entry to Sir Edmund, Softalk/IBM, Box 7040, North Hollywood, CA 91605. Please include your name, address, phone number, and what you want if you win (chosen from the products of this month's advertisers).

As usual, if we receive more than one correct entry, we'll call on the random number generator to pick a winner. Deadline: April 15 (sound familiar?). ▲

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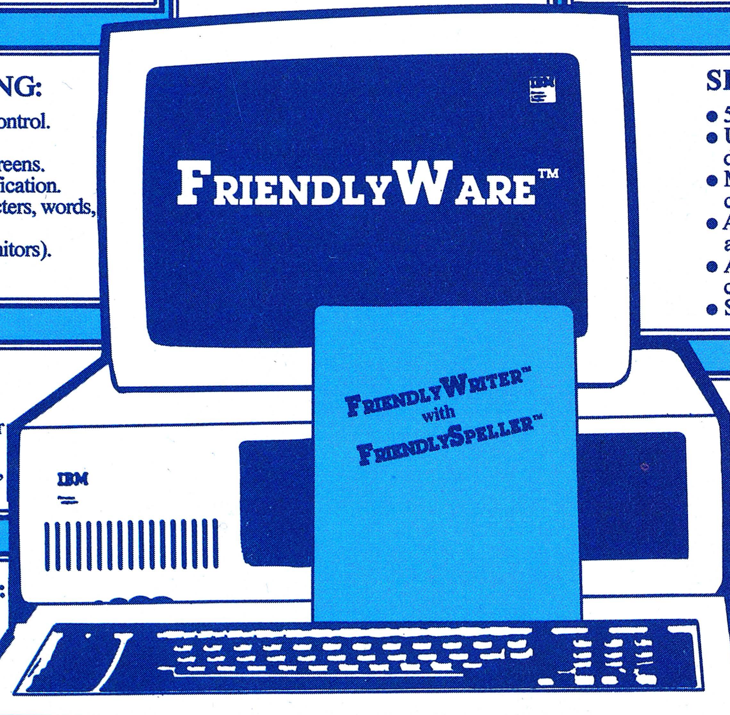

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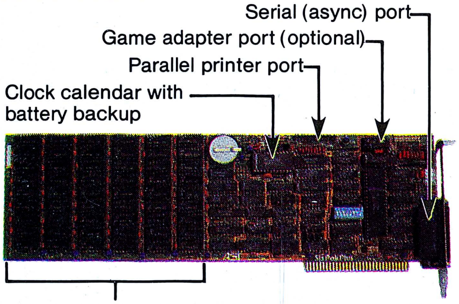
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Game adapter port (optional)
Parallel printer port
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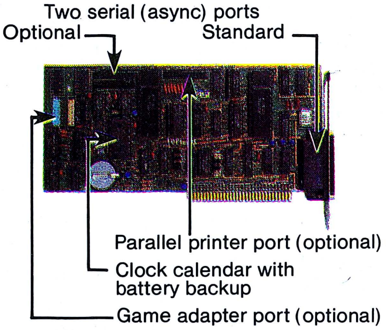
Two serial (async) ports
Optional
Standard
Parallel printer port (optional)
Clock calendar with battery backup
Game adapter port (optional)

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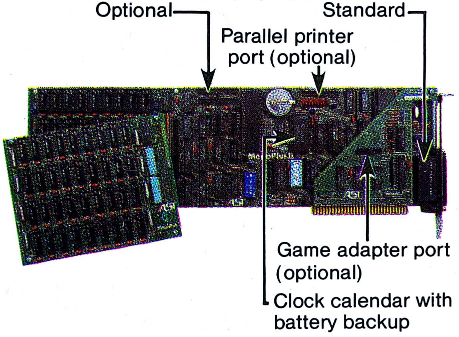
Two serial (async) ports
Optional
Standard
Parallel printer port (optional)
Game adapter port (optional)
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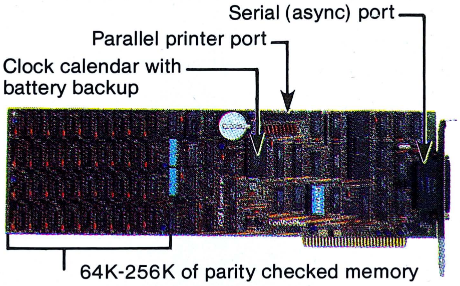
Serial (async) port
Parallel printer port
Clock calendar with battery backup
64K-256K of parity checked memory

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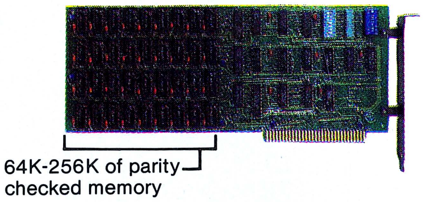
64K-256K of parity checked memory

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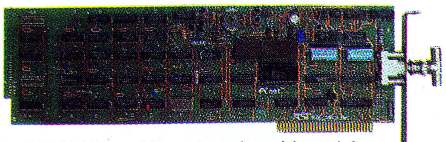

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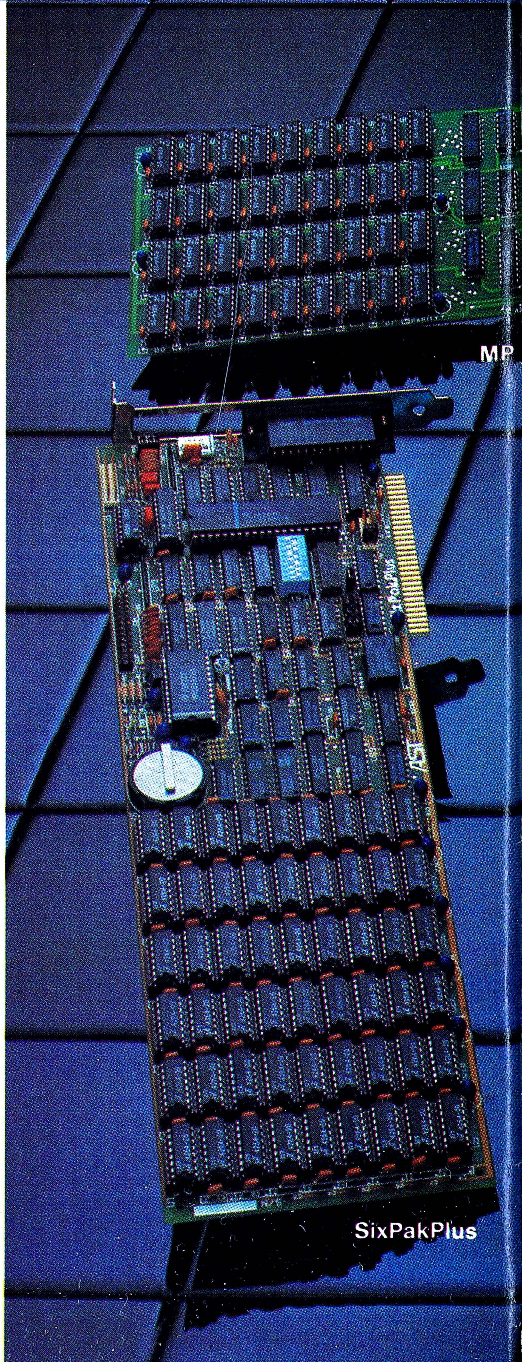
MP
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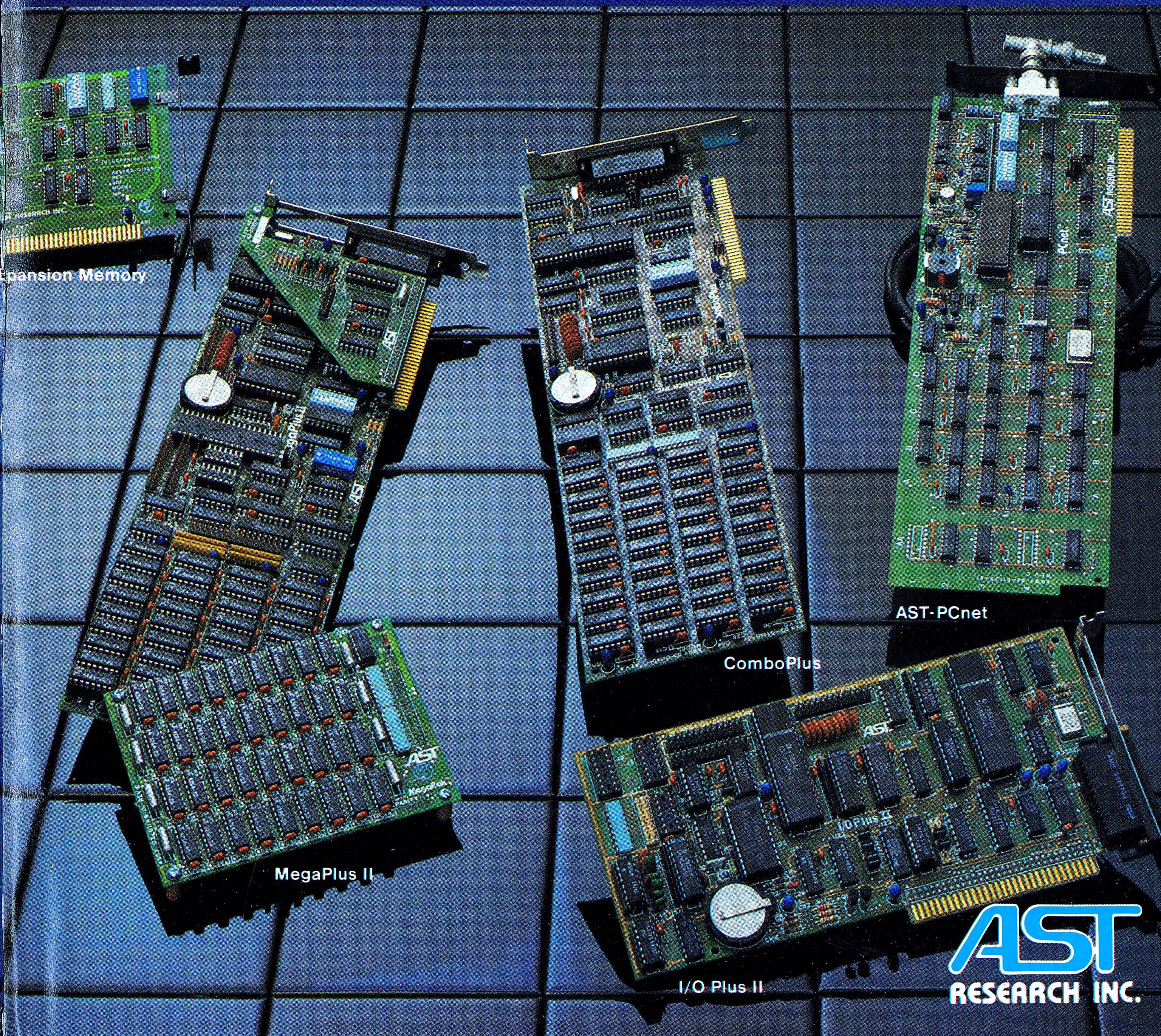

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crosstalk

Lost and Found

The problem started one night after a hard day's pounding on my keyboard. I had shut down my system—an IBM PC, a Targa II hard disk (external) unit with two 15M disks by CMC International, and a few internal add-on boards—and went to eat dinner. When I came back, my boot disk turned over control to what seemed to be a garbled mess of files. After not backing up any of my day's work to floppy, I knew my files would be gone. And I was right.

It seems that for some reason, the hard disk's file allocation table had been destroyed. Since the FAT holds all information pertaining to files, and more important, directories and subdirectories, all access to any file on the hard disk was gone.

Recovering lost files is time-consuming and maddening. DOS provides two methods of recovering nondirectory (lost or damaged) files: *recover* and *chkdsk*. Since I have two 15M fixed disks (one for backup), I tried one method on each. Both methods worked, creating numbered files with a prefix common to all files. The only problem now was to type out each file to see which files were important. With over 450 files, I knew I would be there a long time.

There had to be a way to type out each file, and this is where the undocumented Basic *shell* command came into play. I had often read in *Softalk* that the command didn't work, but since I had over 450 files to type out, I gave it a whirl. To my surprise, the *shell* command worked!

What I did was write a Basic program to increment a counter and create the string variable Fname$; I then used

```
SHELL TYPE FNAME$
```

to see what was in each file. All I had to do was press return after each file dump, and if the file was important, I wrote the filename down for later renaming. So here is one testimonial that the Basic *shell* command works.

My advice is this: Don't create too many subdirectories on your hard disk if you can avoid it. I had over twenty directories with an average of three subdirectories each. The files were still there, but with the FAT gone, the PC had no way to access them.

My solution in case of another crash? A new device driver program I received from CMC International but hadn't previously installed; it allowed the hard disk to be divided in up to eight logical sectors. Since I had just had a crash and needed to reformat anyway, I felt that it was worth a chance.

The software works just fine, and I like the logical sectioning even better. Instead of using the *cd* command to change directories, all I do is select a new drive letter at the DOS prompt. I need only a few directories now, and if I ever have a FAT crash again, only one logical section has to be recovered.

James Rhodes, Tempe, AZ

Kover Kudos

You should have your motherboard pulled out by its microcircuits! Your cover photo of a latest-generation English student holding an unjacketed disk by the access window has set personal computing back 1.328E02 years.

May you be stuck in an uninterruptible *for-next* loop for 32767∧32767 cycles!

Gary P. Winters, Columbia, MO

I received my first copy of *Softalk for the IBM Personal Computer* this week, and was astonished to see the cover photograph. For you, of all people, to portray such reckless disregard for magnetic storage media as is shown in the cover photo is mind-boggling. Not only is the young lady holding a floppy disk with her hands all over the disk surface, but there are at least two other floppies shown, both without jackets, and stored in what can only be described as a hazardous fashion. The only worse practice for disk care would be to hold them to the wall of the metal locker with a magnet or to cover them with ketchup. You should be more careful in how you portray the use of such things.

Robert E. Wood, Chapel Hill, NC

Parity Check 1

What's the PC's real reliability? I've had my PC for just over a year, and only now am really starting to use it. When I work my PC for four or more hours, I sometimes get a "Parity Check 1" reading and must reboot the system. The repair technician has found this problem elusive. However, it may not be an isolated idiosyncrasy as I know of four other PC units down with the same problem.

Maybe someone knows the answer to this problem; to date my PC has been in the shop four times.

John Helle, Chesterfield, MO

Full-Screen Data Entry Modified

I would like to note two articles that have been of particular benefit to me: "BSCBas: Structured Programming in Basic" by Mark Gardner (November 1983) and September's "Basic Solution" by Joe Juhasz.

I modified Juhasz's full-screen data entry so that the screen definition became a file read from disk. However, I wanted a way to define nondata entry fields for things such as displaying the available function keys. I therefore made another file with screen definition capabilities similar to the full-screen data entry file. The changes resulted in a general-purpose full-screen data entry panel that can be fancied up.

To make this a truly general-purpose program I needed to make the program easily modifiable. This is where Gardner's BSCBas program came in. I converted the full-screen data-entry program to the format recognized by the BSCBas program and ran it through the program. By having the program delete the comment lines for a run-only program, I made a full-screen data-entry routine that performs reasonably and can easily be modified.

If any readers are interested, they can send a blank disk and a self-addressed stamped envelope to Box 5724, San Bernardino, CA 92412; I would be happy to send them the modified programs.

John H. Lang, San Bernardino, CA

Microsoft *Word*

Word is indeed a powerful word processing program. But, as a first-generation owner of *Word*, I've had the dubious honor of discovering a serious bug. I thought I'd share how I got around it with other frustrated users.

Word has a command called *transfer* to load files from the data disk to the program disk and to save files from the program disk to the data disk. *Transfer* theoretically allows you to delete files from the data disk that are no longer needed or wanted, thus clearing the disk to receive further information. It fails at this task in two ways.

First, the *transfer delete* command doesn't work. *Word* fails to heed it for some reason, rewarding every attempt to delete a file with the "Not a Valid Command" phrase. Thus you cannot erase or delete files from your data disk through *Word*.

Second, *Word* gratuitously saves your work in a "Mw.tmp" file on the program disk itself. This backup gives you the security of being able to find your information on the program disk, should you somehow lose it on your data disk. However, *Word* does not delete these temporary files at the end of a work session. You can suddenly find yourself, usually in the middle of a session, staring at a "Disk Full" warning as your most recent work is trashed, crowded off a program disk that you thought was, for all intents and purposes, empty. It wasn't.

There are two ways of getting around this bug—both annoying, but far less so than seeing your work drift away into the ether because of insufficient space in memory.

First, end (or start) each work session by deleting *Word*'s temporary files from DOS. You might check the files with the *type* command first. You can also clean up those increasingly crowded data disks just loaded with undeletable files (two copies of each, actually, because *Word* automatically creates a backup file) by erasing from DOS.

I learned to follow this procedure religiously after losing three days' work when *Word* signaled me that its program disk was too full to receive any further information ... and then threw out all my work without giving me the chance to save.

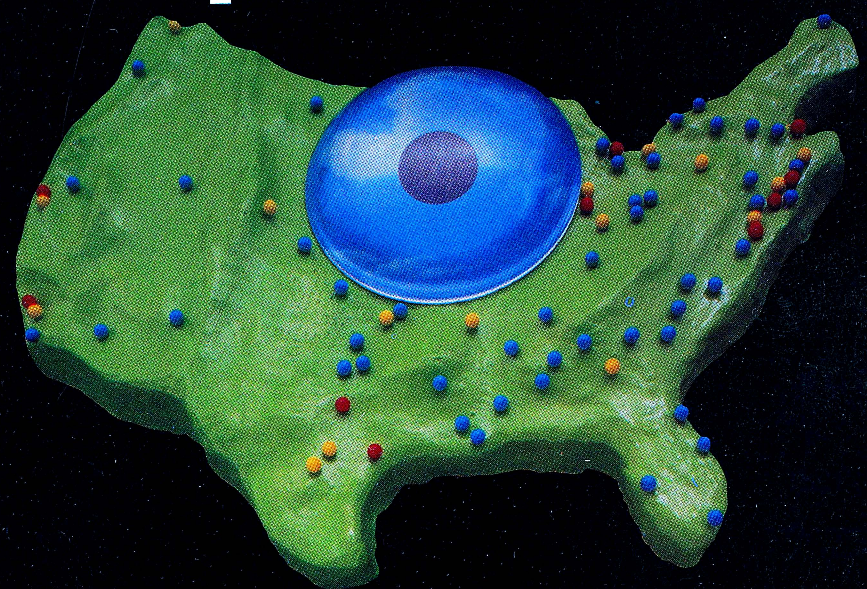
I don't mean to denigrate *Word*. It is an incredible word processor. Having used it and the Microsoft Mouse, I can't even imagine writing any other way. However, the bug exists, and I can only hope that Microsoft will soon correct it.

Bill Mantlo, New York, NY

Microsoft replies: *We have been aware for some time of the two issues Mr. Mantlo raises. Let me outline the reasons behind them and the steps we have taken.*

There are two conditions under which the transfer delete *condition will not function—one intentional, the other an unexpected situation.*

Peripheral Vision



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An attempt to delete a file that has just been loaded, edited, or saved will result in the "Cannot Delete File" error message. We included this feature to protect you from deleting current work and to allow the file Mw.ini to be built correctly. Mw.ini retains, from session to session, information about the files you used and the options you chose (such as the printer driver).

However, we did not foresee that users with exactly 128K who are running under DOS 1.1 would receive the message "Not a Valid File" in response to their attempt to delete files. I suspect this is happening in Mr. Mantlo's case. If you increase your memory to 192K or greater, or if you use DOS 2.0, the transfer delete *option will be once more available.*

The "Disk Full" message is a legitimate operating system message indicating that there is no storage room left on the disk or that the directory is full and can't track any additional files. However, some Word *users have been experiencing disk full messages when neither of these two conditions exists. To guard against this, you can use the status line to monitor the amount of room available in workspace and save frequently to disk. If anything unfortunate occurs, you will have lost at most ten minutes' work. The next release of* Word, *targeted for the first quarter of 1984, will alleviate this disk full problem by altering the method by which the temporary files are created.*

Mr. Mantlo states that he deletes some of the temporary files Word *creates on the program disk. I would caution against erasing Mw.ini. If you erase that file, you won't be able to start* Word *with* Word/L *because the information will no longer be available to recall the last document you edited.*

Alison Conn, Microsoft Product Support

Data Security vs. Airport Security

I am part of a team working on a large application project that has had to incur much airline travel. As a consequence, our disks sporadically have been zapped.

Based on my fleeting memory of high school physics, I don't think that x-rays could have damaged the disks. I do believe, however, that the x-ray equipment's magnetic fields are the culprits. Although we remove the disks from our hand luggage before entering the x-ray machines, we still sustain occasional damage. I believe this happens when we stop to unload the disks in front of the machines.

At this point my tactics are to put each box of disks in a lead-foil film pouch, although I am doubtful this really protects disks against magnetic fields. More important, I carry backup sets of all disks. This has allowed me to recover from any damage.

One of our team members is convinced that some brands of disks are more susceptible to this kind of damage. We're wondering how hard disks react to airport x-ray systems. Does anyone know?

Steven A. Green, University Heights, OH

DOS *Graphics* Command from Basic

Alan Boyd's January installment of "System Notebook" leads one to believe that the DOS 2.0 *graphics* command is difficult to use from Basic or BasicA. This isn't the case.

DOS 2.0 describes the following program which will invoke the Graphics.com driver: *push bp : int 5 : pop bp : retf*. If you aren't using the monochrome screen with your Basic program, the following Basic line will dump the screen: *def seg = &h0 : poke 0, &h55 : poke 1, &Hcd : poke 2, &h5 : poke 3, &h5d : poke 4, &hcb : I = 0 : call I.*

If you wish to compile a program containing this code, change the last statement of the line to *call absolute (I)*. Note that this code installs the machine language program at the start of the monochrome screen buffer. If you wish to install it elsewhere, use a different value for the *def seg* statement.

You may install Graphics.com prior to call-

continued on page 14

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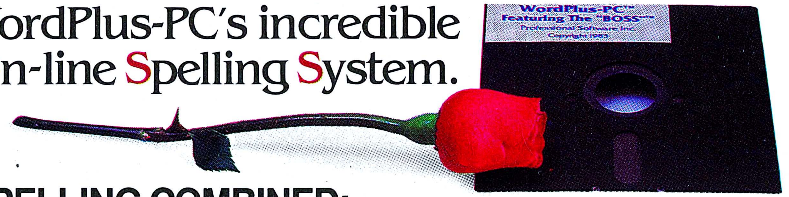

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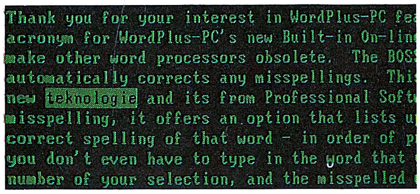

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Thank you for your interest in WordPlus-PC fea
acronym for WordPlus-PC's new Built-in On-lin
make other word processors obsolete.  The BOS
automatically corrects any misspellings.  Thi
new teknologie and its from Professional Soft
misspelling, it offers an option that lists u
correct spelling of that word - in order of p
you don't even have to type in the word that
number of your selection, and the misspelled
```

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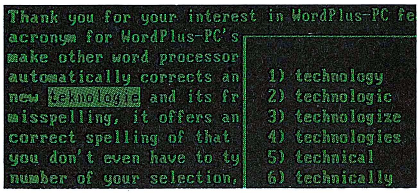

```
Thank you for your interest in WordPlus-PC fe
acronym for WordPlus-PC's
make other word processor
automatically corrects an    1) technology
new teknologie and its fr    2) technologic
misspelling, it offers an    3) technologize
correct spelling of that     4) technologies
you don't even have to ty    5) technical
number of your selection,    6) technically
```

When a word is misspelled, the user can ask The "BOSS" for suggestions as to how to correctly spell the word. With only one keystroke, The "BOSS" will display, in a dynamic on-screen window, up to eight *spelling suggestions in the order of probable phonetic correctness.*

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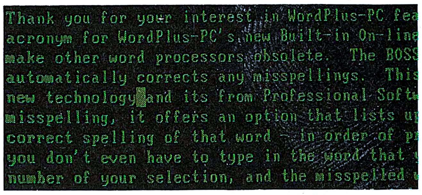

```
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make other word processors obsolete.  The BOSS
automatically corrects any misspellings.  This
new technology and its from Professional Soft
misspelling, it offers an option that lists u
correct spelling of that word - in order of p
you don't even have to type in the word that
number of your selection, and the misspelled
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```
10 Screen 1:CLS:KEY OFF:COLOR 6,1
20 For A = 1 TO 278 STEP 4
30 Circle (320-A,75),A,2,,,75/1
40 Circle (0+A,125),A,1,,,75/1:Next
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ing the program. You may do this, as described, by entering the command *graphics* from the DOS prompt. Make sure Graphics.com is on your disk before invoking the command; if it isn't, only text will be dumped to the printer.

Steven J. Steindel, Atlanta, GA

Helping Hands

I have an inexpensive solution to the problem of not being able to hit more than one key at a time, an ability necessary when using the shift, alt, or ctrl keys.

My father noticed a small jig at Radio Shack designed for holding light items while soldering. The "Helping Hands" (catalog no. 64-2093A) has an alligator clip located at each end of a sliding crossbar attached to the support base. The joints have swiveling clamps that allow great freedom of movement and can be tightened into whatever position desired.

By sliding the crossbar all the way to one side of the base, I can make the jig sit to the side of the keyboard and reach the alt, shift, or ctrl key. Because the keys are located practically equidistant from the base of the jig, I am able to pivot the arm and use the alligator clip as an extra finger to hold down whichever key I want without having to do any major repositioning. The only problem comes when trying to anchor the jig relative to the keyboard. My brother made a wooden tray that holds the keyboard in place and has the jig clamped next to it. The jig could alternatively be attached directly to the keyboard.

I have been tempted to buy RoseSoft's *ProKey*, but at $7.95 the "Helping Hands" is an attractive alternative.

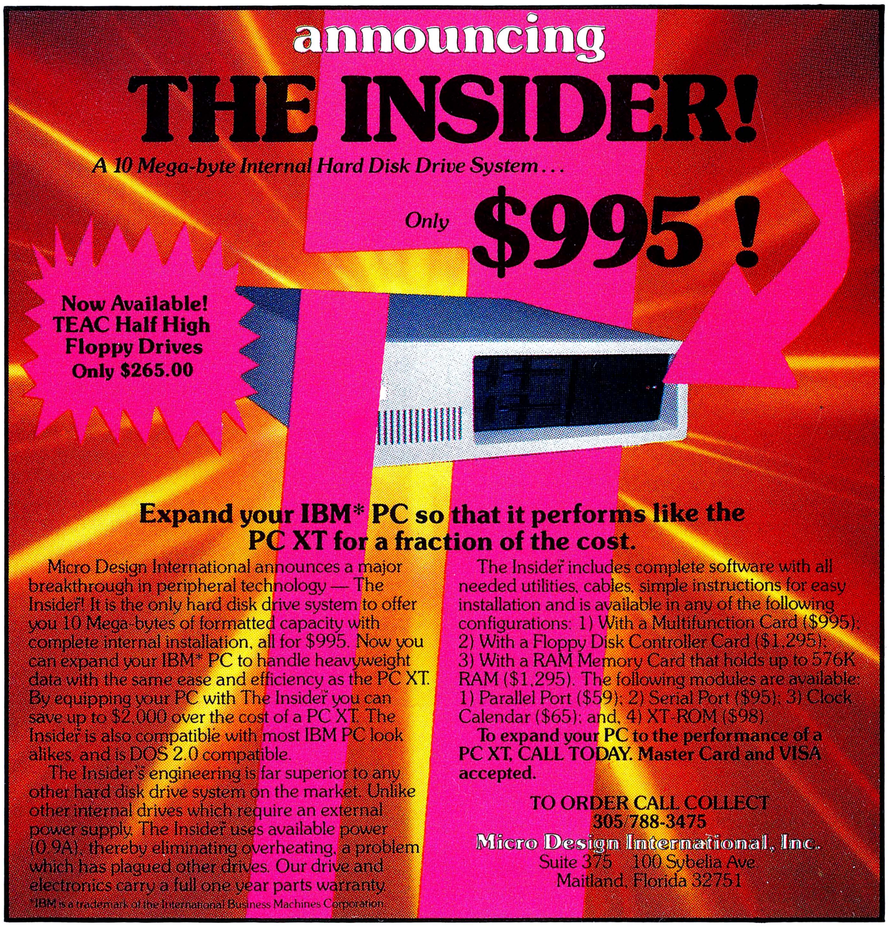
Robert A. Hurlbert, Houston, TX

Fortran Compilers

Jack Wilschke's article on Fortran compilers (November 1983) really hit home because, even after using Fortran for over twenty years, I have been struggling with that compiler that "should never have been allowed on the market."

I've been putting electric motor design problems on my PC using the IBM compiler because it was all I had. I just purchased a Microsoft compiler, Version 3.10. I compared the two compilers using an actual working program and discovered that the Microsoft compiler was 50 percent faster than the IBM compiler. It also gained 180 percent over the IBM compiler in displaying results on the CRT, a point apparently overlooked by Wilschke. The program was written in the interactive mode, so CRT display time is important.

Cyril G. Veinott, Sarasota, FL ▲



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CONTEST WINNERS

The winner of the $100 prize for December's contest, "Sixteen Things To Do with a Dead Computer," goes to Stefan Jones of Locust Valley, New York. A sample from his recycling list: "*Luddite Therapy*: Everyone, even dedicated hackers, feels an urge to smash once in a while. A great public service could be rendered if someone would buy up old machines and set up a technophobia clinic. Clients would have a private cubicle and a dead machine to do with what they would. A clever option would be to rig the machine up to a working monitor that delivers pleading messages—like 'STOP! I CAN FEEL MY MIND GOING, DAVE'—as the client rips the machine asunder."

Time for your history lesson: You'll remember that the Luddites were a group of British workmen who destroyed fabric-making machines because they felt the machines deprived them of work. Lord Byron delivered his maiden speech in the House of Lords defending the Luddites; Byron, as we all know, was the father of Ada, Countess of Lovelace, who helped conceptualize the Analytical Engine and who helped out the U.S. Department of Defense by providing a name for its official programming language.

The $50 prize for best single entry goes to Felice Dublon of Birmingham, Alabama, for "Blow it to *bits* and let the *chips* fall as they may," and "PC it back together."

It's extraordinary how many of you readers thought a dead PC should be used as a cat litterbox. Now really. If that's not a warmed-over cat joke, just what is?

We found this contest to be a valuable way to plumb the national PC psyche and find out what you really feel about your computer; recurrent themes were to use a defunct PC to carry around in cars as a status symbol (to replace the Mercedes-Benz hood ornament?), as an aquarium, a tombstone (with a hacker or one's boss buried beneath), a toilet, a doorstop, an anchor, a drum set, a water cooler, and, in a strange blend of high tech and primitive technology, as ballast for a hot-air balloon. (Maybe someone should write *The Hot-Air Balloon Flight Simulator*?) The most-often-mentioned fate for a computer that had met its maker in the great Big Blue sky was to use a PC for target practice. What hostility this expresses—maybe you folks all need to follow the advice of Stefan Jones and engage in a little Luddite Therapy. ▲

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QUESTIONS & ANSWERS

by Nancy Andrews

Q: Could you explain how to create a hidden file?
D. Racheneur

A: Here is a program, Chmod.bas, that will enable you to make most files either hidden or "read-only"; this program is also a good example of executing a DOS call from Basic. If you use Chmod.bas and mark a file as hidden, all should be well. The file so marked will not appear in directory listings.

If your hidden file is a Basic program, you should still be able to load and run it from Basic. If you mark a Basic program file as "read-only", however, you will not be able to load and run it, because Basic opens all files in the "read-write" mode.

```
100  '   * * * * * * * * * * * * * * * * * * * * * * * * * * *
110  '
120  '                          Program CHMOD
130  '
140  ' Allow a DOS 2.0 disk file to be set to "hidden" or "read-only".
150  '
160  '   * * * * * * * * * * * * * * * * * * * * * * * * * * *
170  '
180  GOSUB 750                               'Read CHMOD routine into CHMOD$
190  '
200  INPUT "Enter the path \ filename of the file:"; NAMEF$
210  NAMEF$= NAMEF$+CHR$(0)                  'DOS expects a zero-terminated name
220  '
230  PRINT "Possible new modes:0=not hidden/not read only (normal mode)"
240  PRINT "                    1=not hidden/ read only"
250  PRINT "                    2=hidden/ not read only"
260  PRINT "                    3=hidden/ read only"
270  PRINT "      enter new mode for";NAMEF$;:INPUT MODE%
280  IF MODE%>3 OR MODE%<0 THEN PRINT MODE%" is no good. Try again."
     :GOTO 230
290  '
300  ' Set NAMEPTR% to point at the first character of the string NAMEF$:
310  '
320  NAMEP    =PEEK( VARPTR(NAMEF$)+1 )     + 256*PEEK( VARPTR(NAMEF$)+2 )
330  IF NAMEP>32767 THEN NAMEPTR%=NAMEP-65536! ELSE NAMEPTR%=NAMEP
340  '
350  ' Get address of first byte of CHMOD$ into CHMOD:
360  '
370  CHMOD    =PEEK( VARPTR(CHMOD$)+1 )     + 256*PEEK( VARPTR(CHMOD$)+2 )
380  '
390  ' Call CHMOD to try to change the file mode:
400  '
410  CALL CHMOD (MODE%,NAMEPTR%)
420  '
430  ' Check the value of MODE% returned by CHMOD:
440  '
450  IF MODE%<0 THEN 470
460  PRINT "Mode of file "NAMEF$" was successfully changed to "MODE%:END
470  MODE%=-MODE%
480  PRINT "Mode of file "NAMEF$" not changed because ";
490  IF MODE%=1 THEN PRINT "you tried to set an illegal mode." :GOTO 540
500  IF MODE%=2 THEN PRINT NAMEF$"'s file could not be found." :GOTO 540
510  IF MODE%=3 THEN PRINT NAMEF$"'s PATH could not be found." :GOTO 540
520  IF MODE%=5 THEN PRINT NAMEF$"'s mode cannot be changed." :GOTO 540
530  PRINT ". . .well, uh, I don't know exactly why,
     but something was wrong!"
540  END
550  '
560  '   * * * * * * * * * * * * * * * * * * * * * * * * * * *
570  '
580  ' Machine language routine to make an MS-DOS 2.0 system call to
590  ' change the mode (aka "attribute") of a disk file. This
600  ' routine is stored in the string CHMOD$. Whenever this routine
610  ' is called, the address of CHMOD$ should be recomputed since
620  ' strings may get moved around by Basic.
630  '
640  ' Example use:          CALL CHMOD(MODE%,NAMEPTR%)
650  '
660  ' Parameters:           MODE% :  On input, this is the new mode you want.
670  '                                It may indicate read-only, hidden, both, or neither.
680  '
690  '                                On exit, MODE% is set to either the mode
700  '                                set OR an error code. Error codes are
                                      negative.
710  '
720  '                      NAMEPTR% : Address of the first byte of the zero
730  '                                terminated path \ filename of the file
740  '                                whose mode is to be set.
750  RESTORE 810:READ X$:CHMOD$=""
760  WHILE X$<>"999"
770      CHMOD$=CHMOD$+ CHR$(VAL("&h"+X$))
780      READ X$
790  WEND
800  RETURN
810  DATA 55             :'PUSH BP
820  DATA 89,E5          :'MOVE BP,SP
830  DATA 8B,76,06       :'MOV  SI,[BP+6]     ;Get address of NAMEPTR%
840  DATA 8B,14          :'MOV  DX,[SI]       ;Get pointer to FNAME$
850  DATA 8B,76,08       :'MOV  SI,[BP+8]     ;Get address of MODE%
860  DATA 8B,0C          :'MOV  CX,[SI]       ;Get new file mode.
870  DATA 81,E1,03,00    :'AND  CX,0003H      ;Allow only "HIDDEN" & "R/O"
880  DATA B8,01,43       :'MOV  AX,4301       ;Indicate "CHMOD" request
890  DATA CD,21          :'INT  21H           ;DOS call to set new mode
900  DATA 72,07          :'JB   ERROR         ;Branch if DOS choked on mode
910  DATA B8,00,43       :'MOV  AX,4300H      ;Indicate "CHMOD" request
920  DATA CD,21          :'INT  21H           ;DOS call to check new mode
930  DATA 73,04          :'JNB  EXIT          ;Branch if no error detected
940  '           ERROR:
950  DATA 89,C1          :'MOV  CX,AX         ;Put error code into CX
960  DATA F7,D9          :'NEG  CX            ;  and negate it
970  '           EXIT:
980  DATA 89,0C          :'MOV [SI],CX        ;Return MODE/ERROR in MODE%
990  DATA 5D             :'POP  BP
1000 DATA CA,04,00       :'RETF 4
1010 DATA 999
1020 '   * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Q: I was wondering if you knew of a way to have DOS 2.0 display the total number of bytes *used* (not remaining) on a given directory. I have written a little "system" consisting of a batch program:

```
DOSDIR.BAT
    DIR > DIR.DAT
    Basic DOSDIR
```

and a Basic routine to do this, but for some reason, the result of the Basic calculations differs from that of the Chkdsk program. By the way, the result of the Basic program equals the result obtained on a calculator.
Arieh Tal

A: If you replace your DosDir program with this one, you should get correct results. If the directory you're checking is a root directory with no subdirectories, your results should equal those given by Chkdsk. If it's a subdirectory, DosDir takes the total amount of file space used and then adds in the size of the directory.

This program differs from the one you sent in two ways: It rounds file sizes up, and it changes the way the size of the directory is computed.

```
100 ' routine to determine DOS 2.0 directory usage
110 '
120 DEFINT F,I
130 DEF FNROUNDUP( NUMBER, ROUND ) =(INT(NUMBER/ROUND)+1)*ROUND
140 OPEN "i",1,"dir.dat"
150 LINE INPUT #1,X$
160 IF RIGHT$(X$,2)="ee" THEN CLOSE 1:GOTO 230: ELSE X$=MID$(X$,13,9)
170 FOR I=1 TO LEN(X$)
180     IF MID$(X$,I,1) >= "0" AND MID$(X$,I,1) <= "9" THEN 200
190     IF MID$(X$,I,1) <> " " THEN FL=1:I=LEN(X$)
200 NEXT I
210 IF FL=1 THEN FL=0:GOTO 150
220 T=T+ FNROUNDUP(VAL(X$),512) :F=F+1:GOTO 150
230 F=F-2:NOTROOT=T+FNROUNDUP(F,16)*32:PRINT
240              ROOT=T+                 112*32 : PRINT
250 PRINT "This directory contains "F" files."
260 PRINT
270 PRINT "If this is the root directory of a 320K disk,
280 PRINT "these files occupy about "ROOT" bytes.
290 PRINT
300 PRINT "If this is not the root directory,
310 PRINT "these files occupy about "NOTROOT" bytes.
320 PRINT
```

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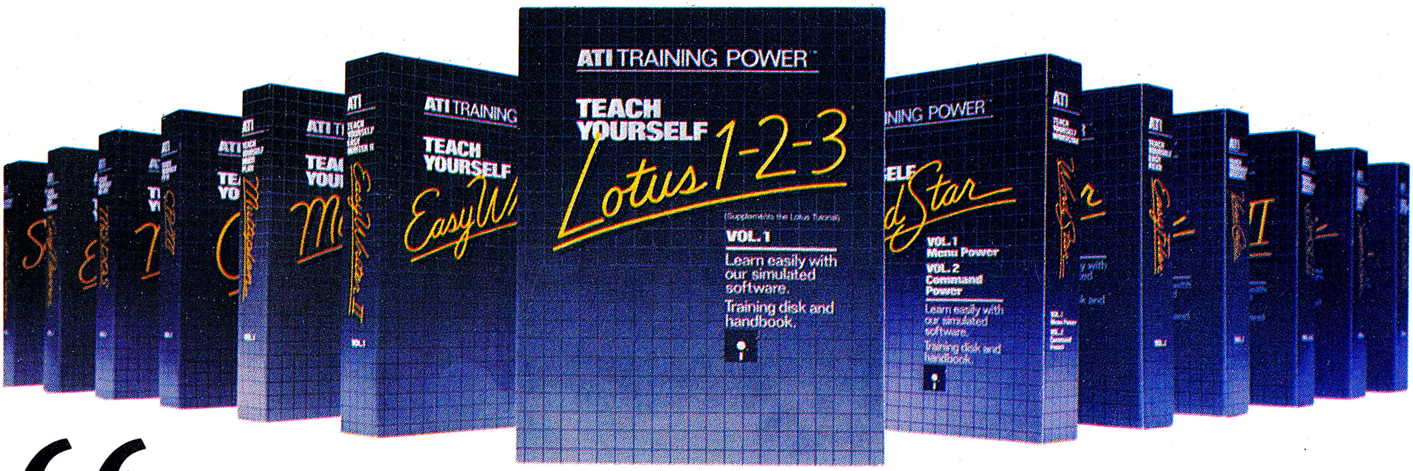
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Q: The IBM *Diskette Librarian* program purchased by our agency several months ago does not work with files created under DOS 2.0. The program writes NAME-OF.DSK on the disk, but does not read the directory and shows in the catalog a "0 Files" entry for those disks.

The program works well on files stored under DOS 1.1 regardless of the version of the operating system stored on the program disk: 1.1 or 2.0. I suspect that the program we have was released before the introduction of DOS 2.0. Whom should we contact or what should we do about it?

Valentin V. Tepordei

A: In the back of the manual are a series of setup menus. If you are using the *Librarian* with DOS 2.0, you need to specify a setup of *INV.*

Q: I use and love *SuperCalc2*, but there is one thing I would like to change. I would like to be able to program the function keys so that they could take over cursor-control functions, leaving me the numeric keypad for data entry. I get frustrated having to switch the right keypad between cursor controls and numeric entry. And using ∧E, ∧S, ∧D, and ∧X leaves a lot to be desired.

IBM function-key reassignment seems limited to Basic, so I wrote a small Basic program to redefine the function keys the way I wanted them to work in *SuperCalc2*. I then ran the program through *SuperCalc*'s .bas-to-.cal interchange, but I haven't been able to merge it into any *SuperCalc* data file. What can I do? Would *ProKey* handle this?

Karl F. Steinhauer

A: We asked Sorcim if *SuperCalc2* would allow function key reassignment, and they said it would not. Evidently, the interchange routine works with data but not with program files. *ProKey* (RoseSoft, Box 45808, Seattle, WA 98105), on the other hand, does work with *SuperCalc2* and will enable you to assign cursor-control commands to your function keys.

Q: I'm working on a program to provide password protection before allowing a user to access my XT. I need to do the following:

1. Disengage control-break to prevent users from interrupting and bypassing the password-entry routine;
2. Have Command.com load the password program (Autoexec.bat isn't suitable, because of the possibility for break and bypass);
3. Have the password program as a read-only file;
4. Reengage control-break in the password program—possibly through a *poke* statement.

The password program is in Basic but could be a .com file.

Could you please help me with these problems? I've been through the DOS 2.0 manual; the more I read, the less I understand.

Robert J. Gody

A: Here's a Basic password program that should solve your problems. It runs under DOS 2.0. To limit access to your system, store in your root directory the following files: Basica.com (from the DOS 2.0 disk), Password.bas (this program), and Password.dat. Make the latter two "hidden" and "read-only" (see "Questions and Answers," January 1984) for greater security. Then add these three commands to your Autoexec.bat file:

```
ECHO OFF
BASICA PASSWORD
ECHO ON
```

Add these commands at the top of the Autoexec.bat, if possible.

When you boot your machine, it will ask for a password and allow for three tries. It will not allow you to backspace while entering the password; one mistake and you have to start over.

If the password is missed three times, the program kills the system by filling low memory with zeros. At that point you'll have to turn the power off and back on again to get another chance.

Be warned, however: You should always leave yourself an alternative way to get into your system—a back door, so to speak. The back door to this version is simple: Enter a right curly bracket and you'll get into the system regardless of what password you enter.

Here's the program listing:

```
1000 '= = = = = = = = = = = = = = = = = = = = = = = = = =
1010 '
1020 'Use BASIC 2.0 key trapping to kill Ctrl-Alt-Del, Ctrl-C, & Ctrl-Break:
1030 '
1040 KEY OFF
1050 KEY 15,CHR$(12) + CHR$(83)        'Ctrl-Alt-Del
1060 KEY 16,CHR$(4 ) + CHR$(46)        'Ctrl-C
1070 KEY 17,CHR$(4 ) + CHR$(70)        'Ctrl-Break
1080 ON KEY(15) GOSUB 1380 : KEY(15) ON
1090 ON KEY(16) GOSUB 1380 : KEY(16) ON
1100 ON KEY(17) GOSUB 1380 : KEY(17) ON
1110 GOTO 1390
1120 BEEP : PRINT "So there!" : RETURN        'Just eat key
1130 '
1140 '
1150 ' Read in password:
1160 '
1170 OPEN "password.dat" FOR INPUT AS 1
1180 LINE INPUT#1,PASSWORD$
1190 CLOSE
1200 '
1210 ' Check user's password entry one char at a time, as entered:
1220 '
1230 WHILE INKEY$<>"" : WEND
1240 CLS:PRINT"enter password:"
1250 TRY = 0
1260 I = 1
1270 A$ = INKEY$ : IF A$ = "" THEN 1530
1280 IF A$ = "}" THEN 1590
1290 IF MID$(PASSWORD$,I,1) < >A$ THEN GOTO 1600
1300 IF I = LEN(PASSWORD$) THEN GOTO 1590
1310 I = I + 1 : IF I > LEN(PASSWORD$) + 1 THEN GOTO 1600
1320 GOTO 1530
1330 PRINT : PRINT "Welcome!" : SYSTEM
1340 'destroy system!
1350 TRY = TRY + 1
1360 IF TRY < 3 THEN PRINT "Wrong! Try again from start of password." : GOTO 1520
1370 CLS : LOCATE 12,36 : PRINT "— death —"
1380 DEF SEG = 0
1390 FOR I = 0 TO 32767 : POKE I,0 : NEXT
```

Q: Lately the space bar on my PC has started screwing up. If I don't use the keyboard for several hours and then try the space bar, I don't get a response for the first couple of tries. Help!

John B. Mudd

A: First, try turning the keyboard upside down and shaking it hard to loosen any particles that may have slipped in and might be causing the space bar to stick. If that doesn't work, try blowing air from a hair dryer at the offending part of the keyboard. If these measures fail, the next step would be to take the keyboard apart and clean it or have a repair person do this for you. If you do it yourself, be careful when you loosen the screws, the keys are spring- loaded. ▲

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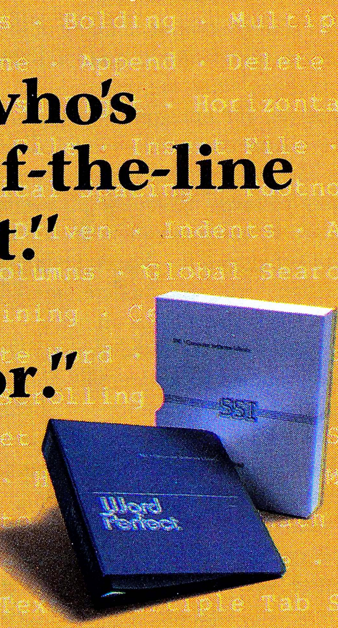

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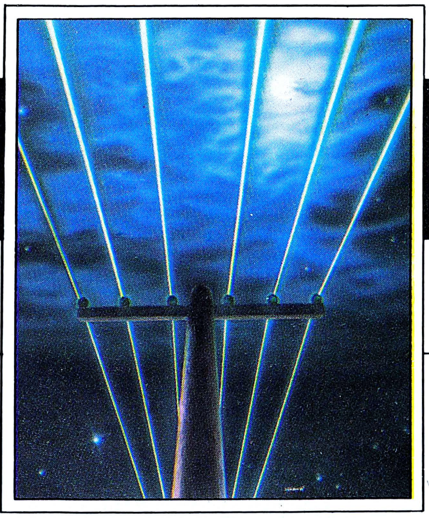

COMM LINES

by Kevin Goldstein

Features of Communication Software

Last month's column discussed the various parameters you have to consider when using communication software—baud rate, parity, number of data bits, echo, and so on. Different services use different combinations of those options. Therefore, most communication programs allow you to control communication parameters yourself so that you can be sure the software will work with a favorite bulletin board or news service.

This time we're going to discuss other options. Strictly speaking, the "options" we'll look at now could more accurately be called features: They aren't necessary for most kinds of communication, but, like power steering or air conditioning, they make life nicer.

Actually, we already examined many of the important features of communication software in previous columns when we discussed modems. Autoanswer, for example, is a feature that involves cooperation between modem and software: The modem must have the hardware necessary to sense when the phone is ringing and alert the software; the software in turn must have provisions for dealing with the ring-indicator signal from the modem, as well as a way to tell the modem to go off hook.

Although most of the software on the market can be programmed to answer the phone automatically, that doesn't mean most of the software on the market will let you call your home-based PC from your office and remotely rummage through your disk files. Sorry.

You see, autoanswer means autoanswer. Period. If you go to work and call your PC (which, of course, you left on, merrily running your comm program), you will indeed be connected to your computer; you will also indeed be able to do nothing much more than send messages to whoever is sitting at the keyboard. That's because the principal function of communication software is to facilitate "conversation"—to let you type in something from the keyboard and receive a reply from afar. That conversational mode is what you are usually dumped into when you first fire up a communication program.

In conversation mode, a communication program merely takes what's coming in over the line and sends it to the screen, and takes what's coming in from the keyboard and sends it out over the line (perhaps to the screen as well, depending on the setting of the echo option). That means, for example, that you can't execute a directory search on the computer at the far end, because *dir* is a DOS command and DOS isn't running (your communication program is running). And if you asked your comm program to transmit a remote disk file to you—the capability to transmit disk files from your machine to a remote location is an almost universal feature of communication software—it would calmly print your request on-screen and then do nothing.

But what did you expect? You are in conversation mode, after all.

If that isn't exactly what you want, however, don't despair. In addition to autoanswer, you need a program with provisions for remote operations, such as uploading and downloading files. Such programs exist. *Host-Comm*, from N.F. Systems, for example, is a popular program that's frequently used for such unattended operations as message delivery, message retrieval, and after-hours order-taking.

Nice, you say, but not really what you want? Still want to rummage remotely through your disk files, view the directory, and just generally pretend you're sitting at a keyboard connected by a fifty-mile phone line?

You don't want a communication program, friend—you want DOS 2.0. The latest version of DOS has a wicked little command called *ctty*, which (IBM tells us) stands for *change console*. (In days of yore, the operator's console on most mainframes was a Teletype; TTY is a common abbreviation for Teletype, so the command really stands for *change Teletype*).

The *ctty* command is a nice example of a clever use of the DOS 2.0 I/O-redirection facility. All *ctty* does is redirect the standard input and output from the keyboard-and-screen duo to some other device. If the other device happened to be a comm port with an autoanswer modem attached, you could in theory access your remote machine almost as if you were sitting right at its keyboard. (There are some things you can't do so well remotely: It's still a little hard to change floppies from far away, for example.)

A cautionary note: This command does not always work as advertised. The advertisement (the DOS manual) looks to be okay, but there seem to be some bugs in the command. It's probably wise to wait for the next release of DOS before depending on *ctty*. If you must use it in the meantime, don't forget you must execute it from the keyboard *before* you leave home or you'll be locked out. Similarly, you should return control to the keyboard before concluding your last remote session of the day, although that part's not critical because you can simply reboot when you get home. Also remember that, unless you take security precautions, it's going to be just as easy for your neighbor's kid to get into your machine as it is for you.

In addition to autoanswer, almost all communication programs for the PC offer a facility to upload and download disk files—that is, to send or receive preexisting files. You don't send disk files in conversation mode; if you key in something from the keyboard (other than a command to the comm program) while a file is being sent, the program should either ignore your keystrokes or queue them up for later transmission. If the program were to intersperse the transmission of your keystrokes with the disk file, your comments would end up scattered throughout the transmitted file. If the file you're sending happens to be a program, it's especially important that the receiving computer close the file before you start sending messages; most messages make truly

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Missing an installment of "Comm Lines"? All back issues of the column—from June 1983— are still available; for further information, see page 4.

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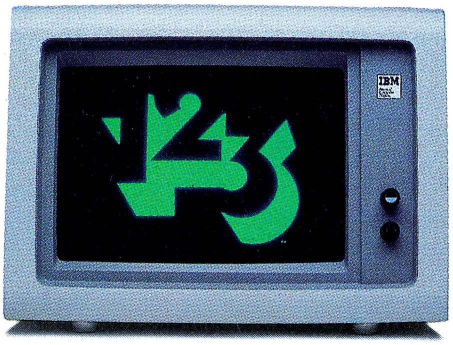

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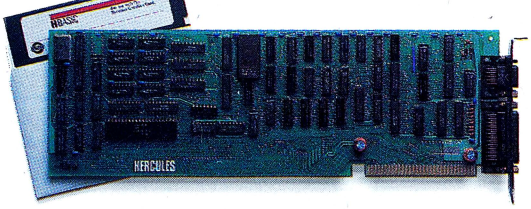

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lousy programs.

Using a program in conversation mode presents no problem, since garbled messages are usually recognizable as such. *Sending* program files, however, is a critical operation, because a mistake can render the whole transmission useless. The moral is to pay special attention to your manual's precautions about uploading and downloading software; mostly, these will have to do with preventing garbage from appearing at the beginning or end of the transmitted file.

Just in case you've been wondering, the terms "uploading" and "downloading"—meaning, respectively, sending and receiving a file—are, like TTY, holdovers from an earlier era. Historically, data was generally exchanged between a large mainframe and small terminals attached to it. Downloading thus came to mean sending a file from the large mainframe down to the small terminal, and uploading meant sending a file up to the large mainframe. (You had to be there.)

Speaking of mainframes, some of them have some positively noxious habits. A particularly nasty one is the use of the control-Z character for purposes other than marking the end of a file. If the computer you're talking to happens to insert a control-Z into a file it's downloading to you, odds are you'll receive the file fine and it will go onto disk okay. Problem is, when you try to play it back, you won't be able to look at anything after the control-Z, since DOS will interpret that character as an end-of-file marker.

To avoid such difficulties, many communication programs incorporate a filter feature that lets you either throw out or translate specified characters. With this feature, you could, for example, simply convert control-Z to carriage return. Strip/conversion filters are also handy for straightening up the carriage return/line feed boondoggle. Because there's no universally accepted line terminator, some systems merely transmit a carriage return while others expect a carriage return/line feed pair. Depending on your system, text received without explicit line feeds might overprint; the cursor might return to the left margin but then proceed to print new data over old. A comm program that lets you replace a carriage return with a carriage return/line feed pair can clean up that mess quickly.

Such filters work in "real time," by the way; data is searched and characters deleted or substituted as the data comes over the line. If you're downloading a file and using a filter, the data will have been checked and conversions will have been made *before* the file is written to disk.

Strip/conversion filters vary in their versatility; some let you replace a whole slew of characters, others only two or three. A three-character filter is probably sufficient for most applications.

If a program is busy running a fancy filter, it may not be able to handle the data as fast as it's coming in. Or maybe you need to change a disk while receiving a file, because the current one is full. Such situations, in which the receiving computer can't handle the data as fast as it arrives, are commonplace. To head off problems like this, many programs implement a system known as the XOFF-XON protocol. The *X* stands for *transmission*, and the protocol simply toggles transmission off and on as necessary.

Using this protocol, a receiving computer overloaded with data sends the XOFF character, ASCII 17??. That tells the transmitting computer to hold up, thereby giving the receiving computer time to assimilate the backlog. When it's ready for more, the receiving computer sends the XON character (ASCII 19??), and transmission continues as if it had never been interrupted.

Not all comm programs recognize XON and XOFF, but most of the better ones do. While you may go for months without ever needing it, the first time your software needs and automatically invokes the XON-XOFF protocol, you'll be glad it's there.

The XON-XOFF protocol is used primarily by the communications port software; if the communication program can't keep up with the data flow, it can resort to XON-XOFF. But suppose you're talking to a large mainframe system, say The Source or CompuServe, and the system is so busy that the main computer simply can't get to your requests as fast as you send them. The large system is unlikely to send you an XOFF, since its communication port is able to keep up; it's the mainframe itself that can't service the requests fast enough. What you have to do is send a line and then wait, send another line and wait, and so on.

Since this problem is relatively common, an optional delay facility is built into many comm programs; it's called *throttling*. To use it, you just specify a time delay; the program then sends a line and waits the specified amount of time before sending the next line. It's a nice feature to have if you plan on using the popular information services during prime time.

That about wraps it up for what could be called operational features—that is, features providing services that you, the user, can't very easily duplicate at the keyboard. Next month we'll look at some convenience features—features you could manage without, but often only if you're willing to do a lot of extra work. ▲

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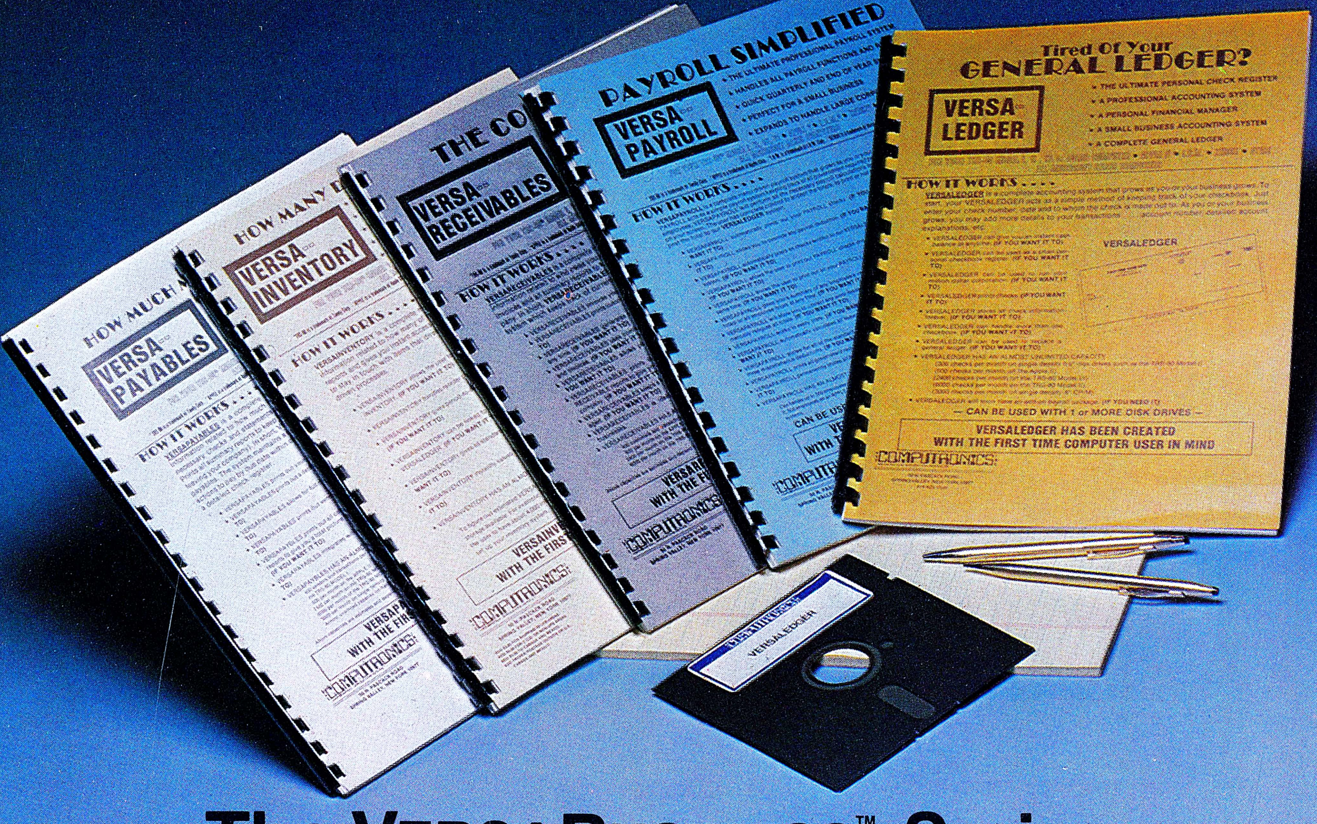

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CORONA SETTLES OUT OF COURT

By Kevin Goldstein

IBM CLAMPS DOWN ON COMPATIBLES

Will IBM go after everybody in the lucrative PC-compatible business? Apparently not.

In an action that could be the first skirmish of a long-running war, International Business Machines Corporation filed copyright infringement suits in late January against a number of PC-compatible manufacturers. The suits allege that the ROM code—specifically the BIOS, or Basic Input-Output System—contained in the manufacturers' PC-compatible computers is sufficiently similar to IBM's own ROM code that it violates IBM's copyright.

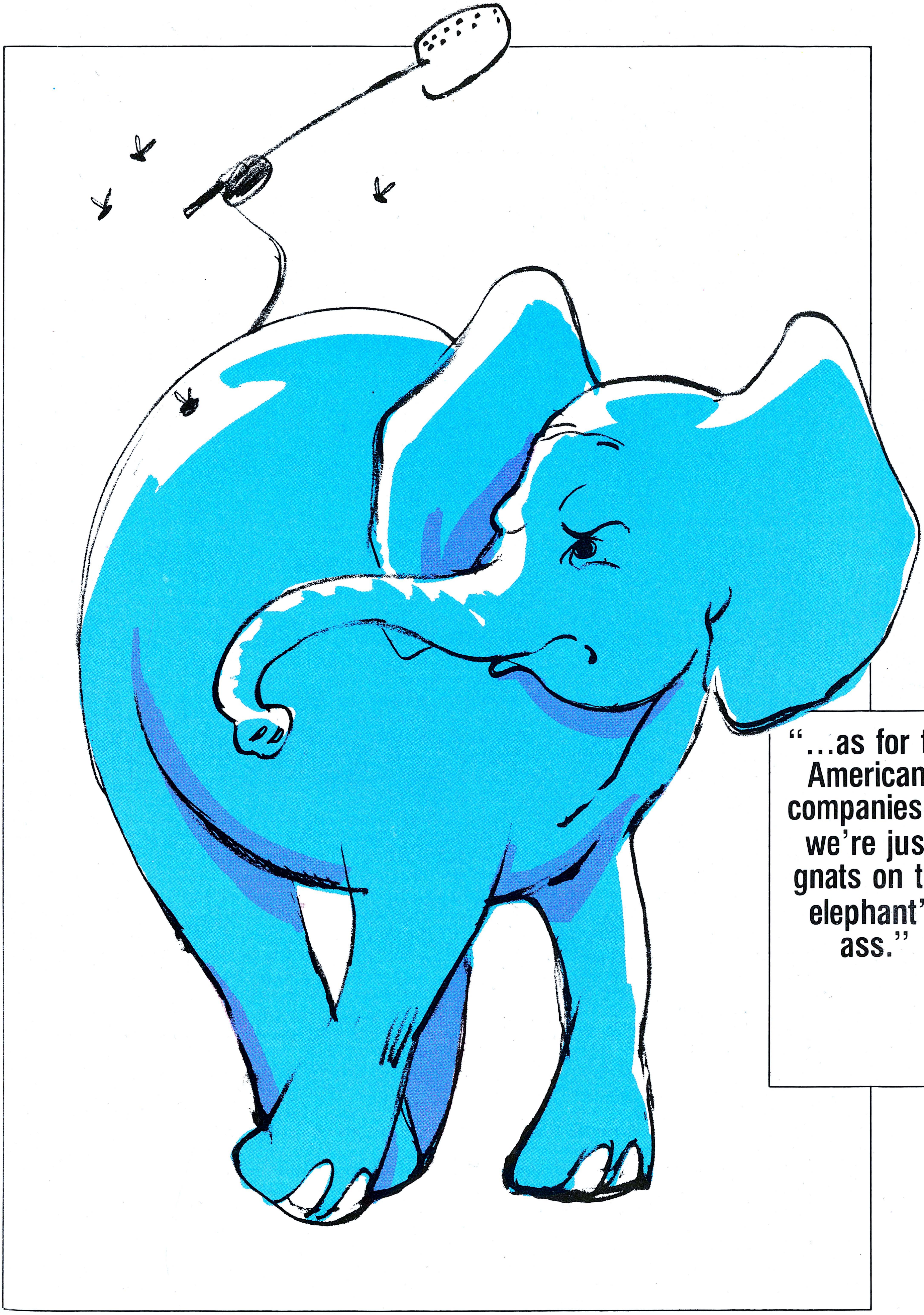
In what at first blush appeared to be a marvel of judicial efficiency, a suit against Corona Data Systems of Westlake Village, California, was filed and settled out of court on the same day. That quick turnaround was not the result of judicial efficiency, however, but of presuit discussions combined with what one industry observer calls "a strong inclination on the part of companies under IBM's guns to get the hell to safety fast." According to that analyst, Corona had agreed to rewrite the offending software even before the suit was filed.

THE CORONA SUIT and its settlement raise some interesting questions—questions that will be of particular import to those who have just bought or are thinking about buying a PC-compatible machine: Are all manufacturers of PC-compatibles vulnerable to copyright-infringement suits from IBM? Has IBM, in fact, sued all the PC-compatible manufacturers, or are they only going after some of them? If the latter is the case, where does Big Blue draw the line? What, in fact, were IBM's motives for going after Corona?

"I'd be both flabbergasted and flattered if I thought IBM was going after companies of our size because they were afraid we could garner a substantial portion of their business," says the marketing manager of a Silicon Valley compatible manufacturer who wishes to remain unnamed. That comment is based on the fact that, like the other domestic PC-compatible manufacturers, his company simply lacks the size and manufacturing capacity to have a substantial impact on IBM.

What's more likely is that IBM's action against Corona is simply the American manifestation of a plan to protect its rights worldwide. In the eyes of the law, if IBM intends to protect its copyright against any infringement, it must protect it against all infringement. In other words, IBM has to challenge those who would copy its code (even if their impact on IBM's business is minimal) in order to establish the principle and the precedent. For much the same kinds of reasons, the Xerox Corporation, in order to preserve the trademark status of the name Xerox, must at least occasionally go after those who would spell that word with a lowercase *x*; they must not allow Xerox to become a generic synonym for photocopy. When the case is seen in that light, Corona appears to be a hapless small fish that got caught in a net being prepared for sharks.

"Some of the Japanese or Taiwanese companies really could swamp the American market with cheap knockoffs," the marketing manager confirms. "But as for the American companies—we're just gnats on the elephant's ass." Already, Japanese giants Sharp, Panasonic, and Hitachi have all announced plans to mar-



"…as for the American companies—we're just gnats on the elephant's ass."

ket PC-compatible machines.

That view of IBM's intentions is supported by the fact that as of February 7, the only other company against which IBM is known to have filed charges is the Taiwanese firm Handwell. (It's rumored that at least two other American companies are under the gun.)

Like the Corona settlement, the settlement with Handwell involved no exchange of money. Both companies simply agreed to quit selling machines that contain the disputed software. And neither company admitted guilt. Corona's agreement with IBM didn't take effect until February 18; according to cofounder and CEO Robert Harp, that arrangement gave the company plenty of time to write a noninfringing BIOS.

If Corona truly was a hapless small fry caught in a net meant primarily for others, that in itself doesn't prove that the company was innocent of copyright infringement. It's reasonable to suppose that IBM doesn't pick its targets by shooting arrows into the air.

There's a technical motivation for compatible makers to stay as close to IBM's BIOS code as they dare.

CORONA WAS ONE of the early birds on the PC-compatible scene, delivering its first machines in January 1983, just a little more than a year after the PC's arrival. By itself, that's not all that noteworthy; Compaq Computer Corporation started delivering machines at about the same time. What's interesting is that, according to Harp, Compaq was able to throw far more resources into the writing of a PC-compatible BIOS than Corona was. The fact that Corona was able to produce its machine in more or less the same time frame is not attributable to magic, however; more likely, they were able to do it because (again according to Harp), there are more than trivial similarities between IBM's BIOS code and Corona's.

Even if Corona had copied IBM's entire BIOS instruction for instruction, though, the company would have had reason to hope that such action might be adjudged perfectly legal. For one thing, with Apple Computer's case against Franklin Computer Corporation still pending, it was not at all clear in late 1982 whether or not ROM code was copyrightable; the question had never been settled in a court of law. (Interestingly, despite a settlement in which Franklin agreed to stop selling machines with the disputed firmware and pay Apple $2.5 million, the question still hasn't been taken up in a court of law; Apple and Franklin settled out of court. More than one lawyer has pointed out that Apple stood to lose too much if it let the case go to court, since it was entirely possible that a court might find ROMs to be uncopyrightable.) Thus Corona could have been hoping, not unrealistically, for a ruling favorable to Franklin.

Even assuming that the outcome of the Apple-Franklin case could have been foreseen, there might still have been reason for a compatible manufacturer to believe it could closely mimic at least some of IBM's ROM with relative impunity. As things turned out, the settlement of the Apple-Franklin suit, while strengthening IBM's position in any potential infringement suit, left a lot of legal questions unanswered; these legal gray areas may well have given Corona more bargaining power.

Indeed the company appears not to have been hurt significantly by its recent set-to with Big Blue. During the year or so that IBM left them alone, Corona was busy grabbing shelf space and market share. And if Harp has been able (as he asserted he would be) to develop a noninfringing BIOS by the time you read this, then all should indeed be well for Corona: No guilt was admitted, no pecuniary penalty was exacted, and the machines will never have been off the shelf. As for publicity, Harp can say he went a round with IBM and came out uninjured; that must prove the company is healthy.

Legal considerations aside, there's a technical motivation for compatible makers to stay as close to IBM's BIOS code as they dare. Had the PC market developed the way the Apple market did, it would have been impossible to make a compatible machine without virtually copying the BIOS. The reason for that has to do with the way programmers use the BIOS, and in particular with the way a lot of Apple II programmers have used that computer's BIOS.

The BIOS is a resource that contains routines to perform elementary operations, such as writing characters to the screen or reading characters from the keyboard. By calling on those self-contained routines instead of rewriting them, programmers can save themselves a lot of time and effort—as well as memory. Assuming they follow the rules, the programmers can also assure themselves of compatibility between their programs and various software-compatible versions of the target machine.

LIKE ENGLISH, which imposes grammar and spelling rules on writers, operating systems (the BIOS is considered to be a form of operating system) impose rules on programmers. A problem arose in the Apple market because many programmers didn't follow the rules.

The primary rule requires that programmers call on (that is, invoke) a given routine properly—which means start at the beginning. It's not kosher for programmers to jump into the middle of a routine just because they know they can get away with it and because doing so might save a few microseconds. For Apple II programmers, the temptation to save a few microseconds (and sometimes a few bytes of code) was great, since the machine is slower and has less memory than newer models. Thus a large number of Apple programs use what are known as *nonstandard entry points*; that is, they jump into (or enter) the middle of BIOS routines.

Such programming practice has serious consequences for would-be manufacturers of Apple-compatible machines. Suppose, for example, a compatible manufacturer writes his ROM BIOS so that, say, the routine for reading the keyboard starts at the same address as the one in Apple's machine. Information about such starting addresses, known as standard entry points, is usually published for the convenience of software developers, so there's no question of copyright infringement here. Let's also suppose that, to avoid any potential infringement problem, the compatible's programmers do not even look at the code in the Apple ROM; they simply write code in such a way that their machine provides routines that are functionally equivalent to those of the Apple.

Suppose further that an application programmer has written some Apple software that calls on the keyboard routine not by going to its starting address but by jumping to a location in the middle—perhaps a location that on the Apple reads the state of the shift key. Our hypothetical compatible maker has included in his keyboard routine a subroutine to read the shift key, but since he never even looked at Apple's ROM, it's monumentally unlikely that his shift-key-status subroutine is at the same location as Apple's. As it's written, then, this piece of Apple application software won't run on the manufacturer's compatible machine.

If a manufacturer's computer is to be truly accepting of all such "illegally" written programs, there is just one answer: Copy

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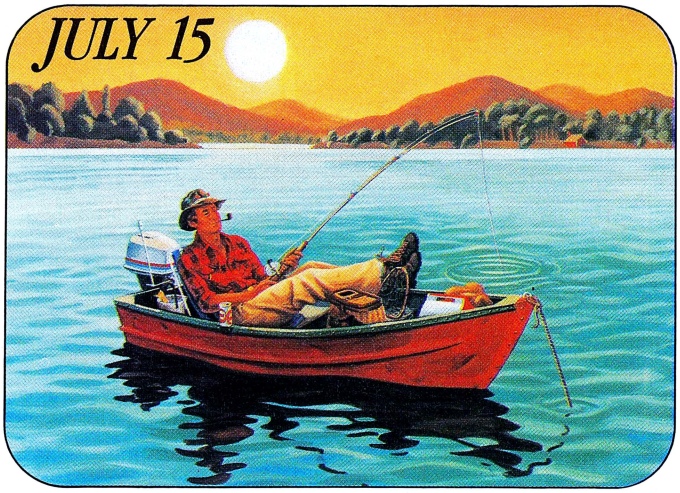

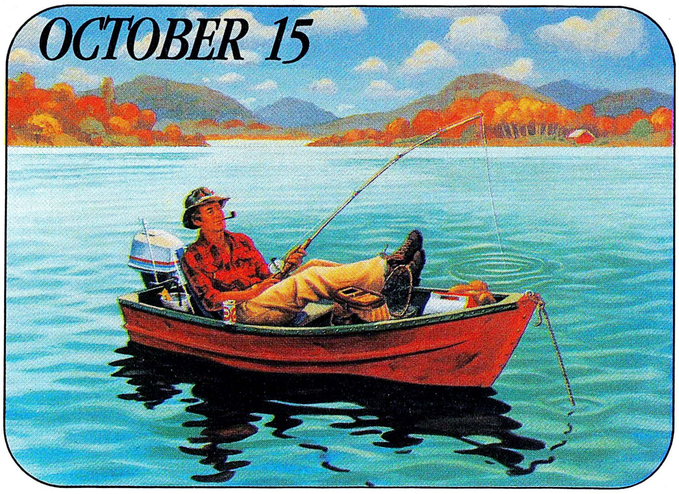

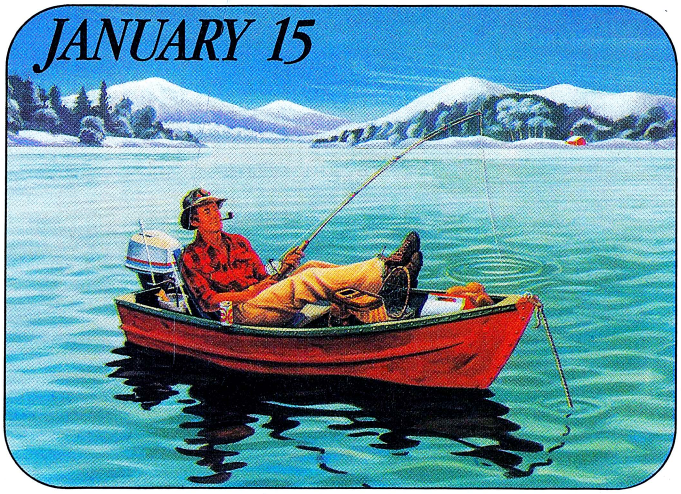

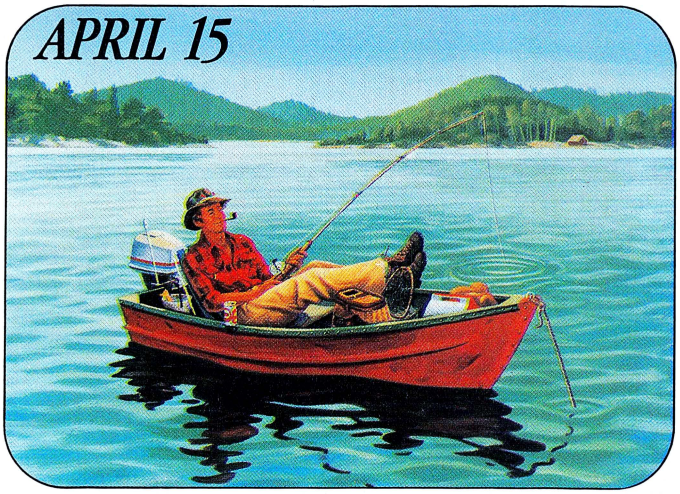

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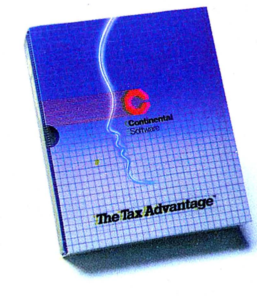

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the ROM exactly.

Corona's Harp points out that his company was one of the first with a PC-compatible, and it simply wasn't clear at the time that IBM programmers were going to be better behaved than Apple programmers. (As it turns out, they have been.) Thus while Corona didn't go as far as copying the ROM exactly, Harp does cite the "illegally written program problem" as a reason for the Corona BIOS's high degree of similarity to IBM's.

WILL IBM GO after everybody in the lucrative PC-compatible business? Apparently not. Many of the other manufacturers claim to have written their BIOS without looking at IBM's. (IBM publishes what are known as *externals*—that is, standard entry points, parameter passing conventions, and functional descriptions of the ROM routines. By referring to the externals, it is possible—if more difficult—to write a PC-compatible BIOS without looking at IBM's.)

For example, Jim Hoffman, vice president of marketing for Seequa Computer Corporation (makers of the Chameleon), says, "Our hardware people had never even seen a PC, and our software people went purely on functionality. They looked at IBM's code only when they finished, to make sure they hadn't duplicated any areas just by chance."

And Compaq's Director of Corporate Communications, Ken Price, says, "We wrote our ROM from scratch. If they were concerned about our ROM, they'd have done something by now—we've been on the market a year and a half." (The year is perhaps irrelevant if IBM was waiting for a resolution of the Apple-Franklin case, but IBM has had plenty of time to take action against Compaq since that resolution.) Eagle Computer, like Compaq and Seequa, claims to have written its code from scratch.

How many companies will IBM confront? As many as it feels it needs to. It's worth keeping in mind, however, that the assumption underlying IBM's action against Corona and others—the assumption that ROM code is copyrightable—has to this point neither been upheld nor denied in a court of law. The meaning of copyright and copyrightability seems, in fact, more uncertain than ever; for a discussion of these issues, particularly as they relate to the computer industry and as they appear in the wake of the Betamax decision, turn the page. ▲

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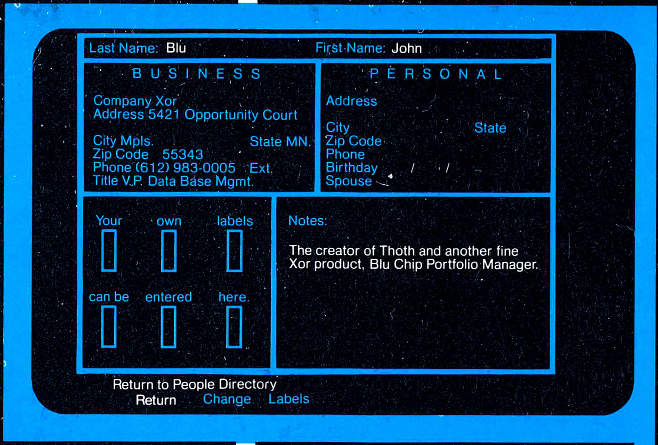

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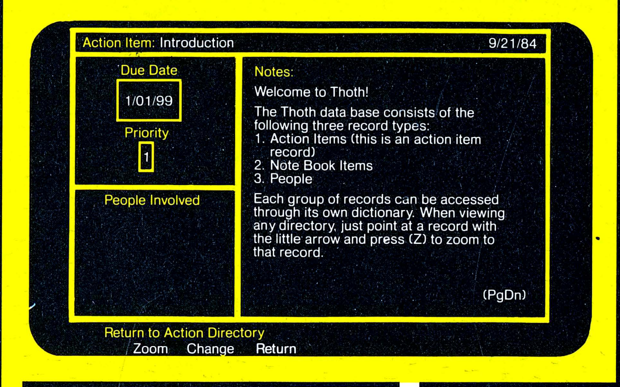

Action Item: Introduction 9/21/84

Due Date
1/01/99
Priority
1

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1. Action Items (this is an action item record)
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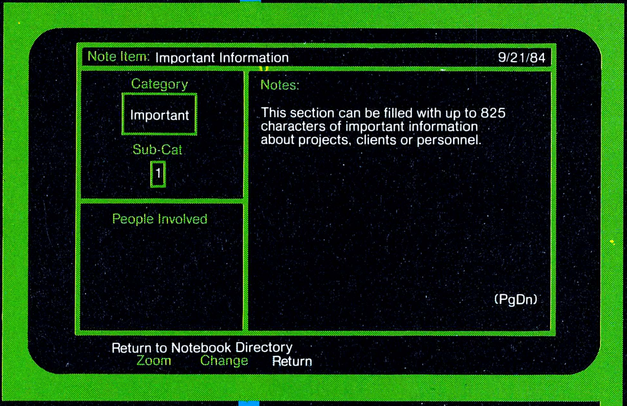

Note Item: Important Information 9/21/84

Category
Important
Sub-Cat
1

People Involved

Notes:

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By Herbert Swartz

THE IMPACT OF THE BETAMAX DECISION ON THE (SORRY) STATE OF COPYRIGHT LAW

Betamax was the first time the Court defined "fair use"; it took only 143 years.

On January 17, the United States Supreme Court finally made up its collective mind on the Betamax case. The case had been in the federal court swim since 1976 and had been before the Supreme Court for more than two years. By a five-to-four margin, the court decided that owners of videocassette recorders were not infringing the rights of television producers by making copies of TV programs.

Copyright law will never be the same.

"Every defendant in a copyright infringement suit henceforth will raise the case as a defense," predicts attorney Jon Baumgarten, former general counsel to the United States Copyright Office. "And every copyright plaintiff will have to avoid it [the Betamax case]."

Legal protection for the microcomputer industry has been severely attenuated by Betamax. But it was never strong in the first place.

Patent law has always been too expensive and dilatory, and probably was never applicable to software in any case. Trade-secret law, nebulous at best as applied to microcomputer concerns, may well have been preempted in 1976, when Congress passed its most recent Copyright Act.

Now copyright, all that was left, has been twisted like the proverbial pretzel.

How will Betamax affect the microcomputer industry?

Copyright is not a natural right, neither according to the writings of John Locke nor according to the Constitution. Rather, the Constitution (in Article I, section 8, clause 8) empowers Congress to protect the "exclusive rights" of authors to their writings, for the overall purpose of furthering knowledge. Give authors the incentive to create, goes the thesis, and wisdom will increase. Classic first-year poly sci.

There were limitations to copyrightability. "Exclusiveness," for example, was construed to extend only to the form in which an idea was expressed, not to the idea itself (you can copyright *Othello*, but you can't copyright jealousy and treachery as dramatic themes). And "staple articles of commerce"—that is, objects—were also uncopyrightable.

Nevertheless, within the scope of what was considered copyrightable, "exclusive" meant exclusive. One was pregnant or one wasn't. "Balancing" and "equitable rules of reason" (and all those other malleable phrases that translate fixed standards into whatever a judge says they mean) came later.

BUT NOT TOO much later. By 1841, copyright "exclusiveness" was already a little bit pregnant.

In that year, a federal court in Massachusetts postulated for the first time something that later came to be called the "fair use" defense to copyright infringement:

> *In short, we must often, in deciding [infringement] questions of this sort, look to the nature and objects of the selections made, the quantity and value of the material used, and the degree in which the use may prejudice the sale or diminish the profits, or supersede the objects, of the original work.*

"Exclusiveness" would henceforth be subject to exceptions.

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We were on the road to "balancing" and "equitable rules of reason."

Amazingly, in retrospect, lower federal courts had the "fair use" ball all to themselves for better than a century. Congress did not codify "fair use" until the 1976 Copyright Act; and the Supreme Court did not interject its version of "fair use" until mid-January of this year. Yes, Betamax, *mirabile dictu*, was the first time the Court defined "fair use"; it took only 143 years.

When Congress passed the 1976 act, it set forth in section 106 an author's obligatory "exclusive" rights under five headings: reproduction (copying), distribution, display, performance, and the making of derivative works. Then, in sections 108 through 118, the Act provided the narrowest of exclusions to these rights. Section 108 permits a library to make *one* photocopy; section 117 permits the owner of a computer program to make *one* backup copy.

Section 107, the "fair use" exception to "exclusive" rights, was another matter, however. The purpose of this section was ostensibly to codify the doctrine, but the section in fact did nothing to define the boundaries of fair use.

So with the Betamax case, we bid farewell to "fair use" as we have known it.

From 1841 to 1976, federal judges had pretty much developed the "fair use" doctrine as follows. "Fair" use had to be "productive" use; if you were going to copy part of a first work it had to be for the purpose of creating a second work. And you had to be a scholar to boot. This provision would prevent duplication of research. Creativity would be spurred and knowledge furthered. (The thesis was memorably epitomized by Harvard Law School's great copyright scholar Zechariah Chaffee, Jr.: "A dwarf standing on the shoulders of a giant can see farther than the giant.")

With the furtherance of knowledge as its operating principle, "fair use" implied scholarship, not mere entertainment; it also implied a second work, not merely the use of a work for the purpose for which it was originally intended (the original use came to be called "ordinary use").

And even under those narrow constraints, "fair use" was further limited to "copying in part." The first author's entire work was not "fair" game. Infringement—premimeograph, Xerox, VCR, and microcomputer—meant a work "substantially similar." *That* was wrongful copying.

The "fair use" doctrine raised the standard by which copying was judged to be infringement to "substantial taking." A scholar in his partial copying was allowed to go as far as "substantial taking," while everyone else was limited to "substantial similarity." But "substantial similarity" and "substantial taking," though different, both meant something less than exact duplication.

In short, exact duplication of a work wasn't even a gleam in a pirate's eye.

WHEN CONGRESS, in 1976, decided finally to codify "fair use," it flirted with what Alan Lipman, a professor at New York University Law School, has called "a paradigm of terseness." The statute, as originally proposed, read: "(T)he fair use of a copyrighted work is not an infringement of a copyrighted work."

Why didn't Congress leave the statute that direct and uninvolved? After all, the House Report to the 1976 act stressed that section 107 was "intended to restate the present judicial doctrine of fair use, not to change, narrow, or enlarge it in any way."

If the paradigm of terseness had been the statute, Congress would have been leaving "fair use" totally in the hands of the courts (where it always had been), with one minor change: "fair use" would have become an exception by statute to the "exclusive" rights of copyright holders, rather than a judge-made defense to copyright infringement. Such a change would have portended little for the marketplace.

But Congress heard the siren call of the new technology. The House Report indicated that Congress wanted to provide for "the endless variety of situations and combinations of circumstances that can rise in particular cases." Therefore no paradigm of terseness.

The House Report continued: "The bill endorses the purpose and general scope of the judicial doctrine of fair use, but there is no disposition to freeze the doctrine in the statute, especially during a period of rapid technological change." In consequence, and despite its intention not to change the doctrine, Congress, by promulgating leeway for the courts and with one eye peeled for "rapid technological change," expanded "fair use" far beyond what it ever had been.

Under section 107, "fair use of copyrighted work ... includ(es) such use by reproduction of copies." So gone is the boundary of "substantial taking." And since "reproduction" is permissible "for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research," gone as well are the prohibitions against "ordinary use" and the second-work requirement. As for "purposes" in the new section, they include just about anything a court says they include, since the statute defines "such as" to be "illustrative and not limitative."

In fairness, Congress did, in one part of section 107, attempt to rein in judges: "(T)he factors to be considered [in determining 'fair use'] shall include—the purpose and character of the use ... the nature of the copyrighted work ... the amount and substantiality of the portion used ... and the effect of the use upon the potential market for ... the copyrighted work."

Congress tried, but they did a lousy job.

"Including" is also defined in the Act as "illustrative and not limitative." The statutory language, in fact, is all descriptive and not prescriptive. The language fails to realize the Congressional intent not to change the doctrine in any way.

Further, the factors, as Stanford professor Leon Seltzer notes in his book *Exemptions and Fair Use in Copyright*, are presented in no particular order; nowhere does the statute indicate what factors are more important than others. The words are merely stated. As laws, they are without meaning.

IN PASSING the 1976 Copyright Act, Congress unlocked Pandora's box. Judges, who love to make policy in any event, are now operating under a statutory adjuration to make "fair use" policy. To their credit, federal court judges (prior to the Supreme Court's Betamax decision) resisted the invitation. The 1981 decision of the intermediate federal appellate court in the Betamax case was a model of traditional "fair use" doctrine. But since Congress had unlocked the box in the first place, the Supreme Court decided to lift the cover. The effort seemed appropriate; 143 years of inertia and silence was enough.

So with the Betamax case, we bid farewell to "fair use" as we have known it. And we say hello to a new copyright world in which, notwithstanding an author's "exclusive" rights, others are free to use his work until they commit "an unfair use"—in the words of New York attorney Walter Klasson.

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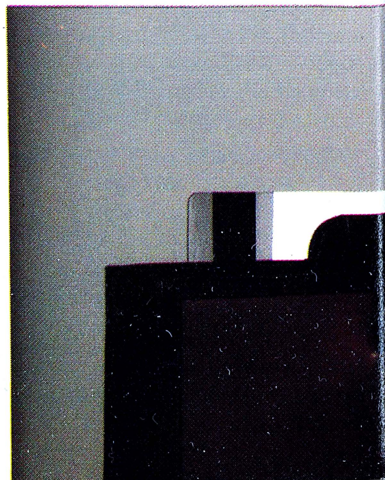

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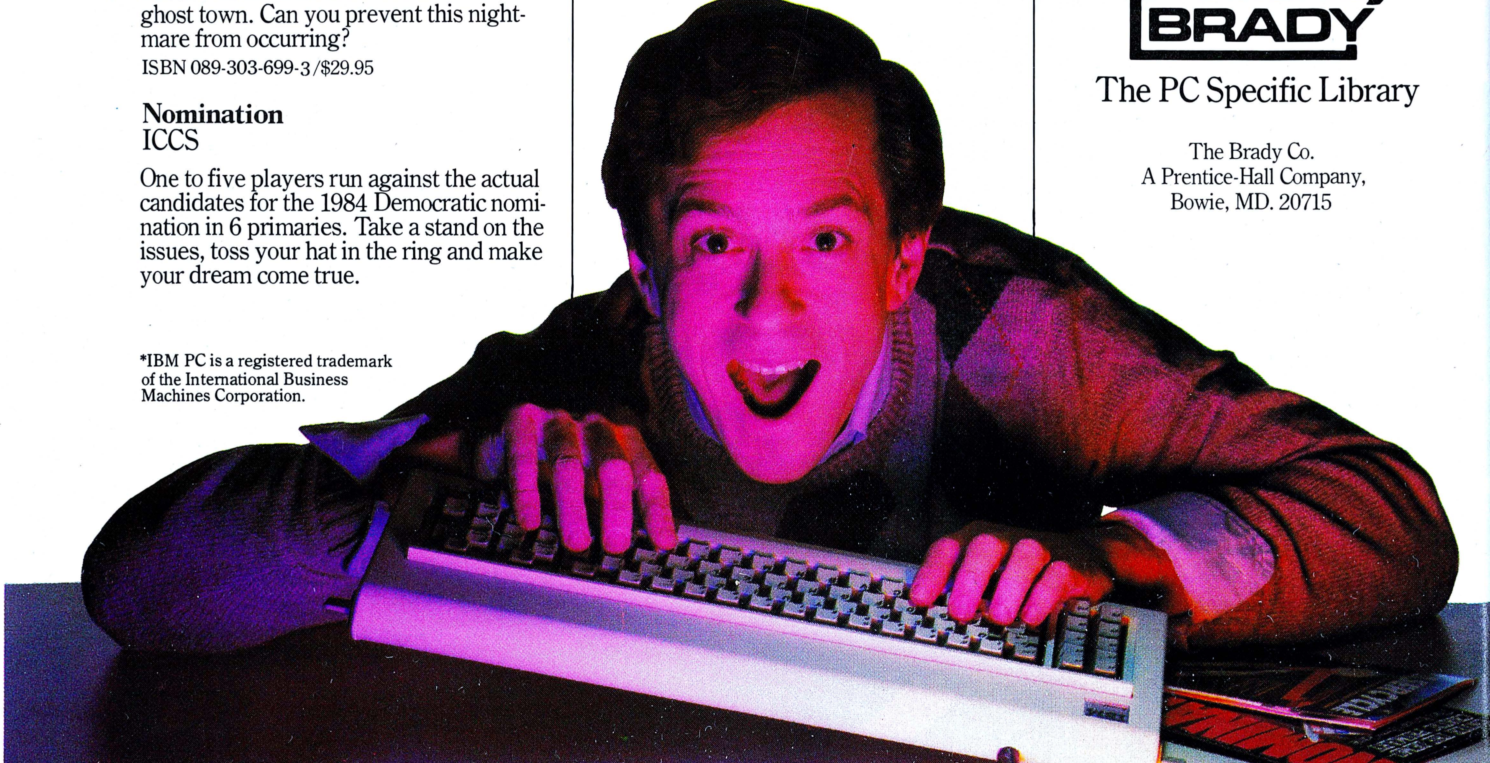

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"In copyright law," says Klasson, "'fair use' used to mean what you could do. Now it is limited to what you cannot do. That's not two sides of the same coin, especially after lawyers and judges get through with it."

The Supreme Court's five-person, thirty-seven-page majority opinion (the dissent was forty-four pages long) is oh so deceptively simple. Universal and Disney sued Sony for copyright infringement and an injunction because Sony was selling VCRs. The Court said no. The recorder is a "staple article of commerce." One of its major uses is time-shifting: A person tapes a television show for later viewing, then sees it, and afterward erases the tape. If that is "fair use," wrote Justice Stevens for the majority, the limited copyright monopoly cannot be employed "to encompass control over an article of commerce that is not the subject of copyright protection." The copyright tail is not to be used to wag the commerce dog—no more in this case than with the photostat machine, the computer, or the printing press, all of which people employ for purposes that violate copyright law. These "articles of commerce" have significant noninfringing uses; therefore copyright law cannot prohibit their manufacture, dissemination, and use.

By presenting the case in such a manner, and by declaring time-shifting a "fair use," the Court avoided getting into the issues that arise when a person doesn't erase the tape, when he "librarys" it or sells it or trades it. Because data from the original Betamax trial (1976) showed that time-shifting was a major use of the VCR, and because the VCR is a "staple article of commerce," nothing else had to be considered, sanctified, or prohibited.

BUT IN THE process of saying that time-shifting is "fair use," the Court inflicted broad damage. The tone was set.

Now a Supreme Court opinion exists that says "fair use" encompasses "ordinary use" (after all, what else is home taping, even the time-shifting variety?). A creator used to have full control over his work, notwithstanding "fair use," for the purposes for which the work was created or distributed. This is no longer the case. Now also, "fair use" permits exact duplication. What ever happened to "substantial taking"? In addition, "fair use" formerly required a second work—a "productive use." No more, said the Court; as Justice Stevens said for the majority, "A teacher who copies to prepare lecture notes is clearly productive. But so is a teacher who copies for the sake of broadening his understanding of his specialty." All of which prompts one to ask: What about a computer executive who copies to aid his own company's R&D? Indeed, how broad is scholarship, the pursuit of knowledge—the former boundary of "fair use"—now that these topics include mere entertainment?

The damage doesn't stop here. In order to extirpate the formal roots of "fair use"—something Congress had toyed with but not done—the Court had to change the format of the doctrine itself. So hereafter, "fair use" means "balancing"; it is an "equitable rule of reason," according to Justice Stevens. That has to be the situation in order to justify the changes made by the Supreme Court. Pandora's box is now open all the way. "If I were a law-school professor," says attorney William Patry, a colleague of Baumgarten's and author of a forthcoming book on "fair use," "I would not give the opinion a passing grade."

Patry's criticism extends to the Court's distortions of section 107. For example, the Court posits a commercial-noncommercial distinction for "fair use," based on section 107. But that is not what the statute says. Rather, it reads: "(T)he factors to be considered shall include the use, including whether such use is of a commercial nature or is for nonprofit educational purposes." Says Patry: "'Nonprofit educational purposes' do not mean anything and everything noncommercial, as the Court indicates. That is the only way time-shifting becomes a 'nonprofit educational purpose.' The result doesn't make sense. Time-shifting is just not educational."

The Court, of course, had already destroyed another part of section 107 when it gave its imprimatur to total duplication. For the statute reads: "(T)he amount and substantiality of the portion used in relation to the copyright work as a whole." Again, it seems self-evident that the statute refers to copying part of the work, not the whole.

And the destruction of section 107 was not over. A further criterion for distinguishing "fair use" from infringement, according to 107, is "the effect of the use upon the potential market for or value of the copyrighted work." This has always been thought to mean that the defendant must show that his alleged "fair use" doesn't, in fact, cause harm. "Fair use," remember, was a *defense* to what was otherwise copyright infringement. Even without the showing of harm, harm was assumed.

But the Betamax decision has shifted the burden; now the copyright holder must show the harm. This is what prompts Klasson to say we now have "unfair use." All uses, in effect, are innocent until proven guilty. It is all so simple, comments attorney Daniel Brooks, head of the Computer Law Association in Washington: "No harm, no foul. But that is not copyright law."

Look for charitable corporations, R&D, libraries, and schools as pretexts for copying.

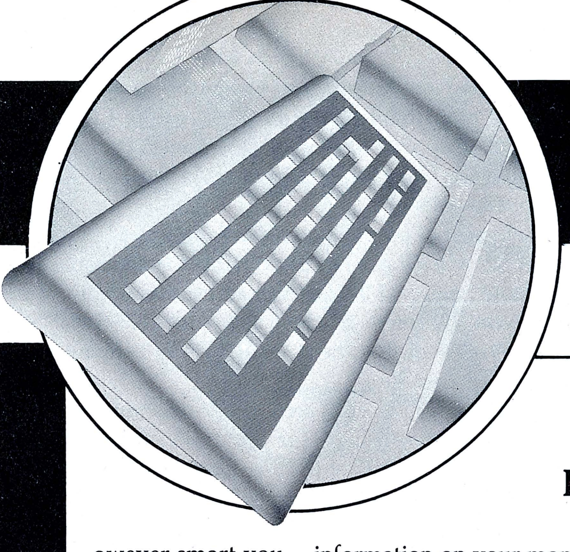
THIS PART OF the opinion on "harm" does violence to more than just "fair use" and section 107. It shakes the very foundations of copyright, adds Patry. The 1976 act provides for statutory damages precisely because harm in a copyright case is so hard to prove. But henceforth a plaintiff must shoulder the burden of showing harm.

Perhaps most important of all, copyright law as a viable enforcement tool lives or dies with an injunction. Up to this point, injunctions have been a fairly available remedy. The Betamax case, however, sets a different tone, not just for "fair use" but for copyright in general; as a result, injunctions are going to be harder to secure in the future.

Copyright law has truly been savaged. How much this lack of protection will injure the computer industry remains to be seen. It may depend on how imaginative lawyers can be, how fearful judges. Look for charitable corporations, R&D, libraries—all dressed in the raiment of "fair use"—and schools as pretexts for copying.

Apart from that doctrine, consider *Apple v. Franklin*. Would the Supreme Court—will the next federal court—find a company's computer an infringement of copyright if it contains the copyrighted object code embedded in the ROM of another company's computer? For recall, the computer too is a "staple article of commerce." Finding copyright infringement if the ROM is copied from another's computer—precisely the Franklin case—takes the product out of commerce. "But without the ROM, there is no computer," counters Brooks. Quite right, but what will courts do with the issue—assuming they even agree with Brooks?

Because of the Betamax decision, the prospects for copyright law and the computer industry are dismaying. More and more, the law of the jungle will be replacing the law of the marketplace. ▲



BEGINNERS' CORNER

by Kathy Talley-Jones

First Conversations with DOS

However smart you may think it is, your computer does little more than take information you've given it, make that information run around in circles, and spit results back out to you.

From your perspective, this information could be anything from a letter to the *Times*, to the yearly sales projections of your Fortune 1000 company, to programs too abstruse to contemplate; to your machine, it's just information.

When the computer is on, you can view the information on your monitor or send it to the printer; when you turn the machine off, the information you've entered is gone unless you save your work.

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How do you save your work? Well, you can't write information on the PC*jr*'s cartridges, so if you want to save your *Crossfire* high score you're out of luck. A cartridge stores the game or the other program information, but cartridges are a form of permanent (sometimes called read-only) memory; you can't add anything to or subtract anything from their contents.

So if you have an entry-model PC*jr*, you're more or less limited to running what the cartridges give you—unless, of course, you're working in Cassette Basic or Cartridge Basic.

Cassette Basic appears if you switch on the Junior and have no cartridges in the slots (if you have an enhanced Junior, Cassette Basic comes up if no disk is in the drive). Junior runs its self-check, and then the Basic screen is before you, waiting with its *Ok* prompt.

If you have no disk drive and want to store something you generate in Cassette Basic or Cartridge Basic, you'll need to have a cassette tape recorder—that's why it's called *Cassette* Basic (not everything is obscure in computer nomenclature). Almost any garden-variety recorder will do, but it would be best to have one that works well, has fairly clean tape heads, and has a meter that tells you where you are on the tape— this meter will be your only way of telling where your Basic program begins and ends.

You can save a Basic program to tape much as you would save it to disk. When you're ready to save it, just type *save* followed by quote marks and the name of your program (in eight characters or less); but be sure your cassette player's play and record buttons are down before you hit the enter key. See IBM's Basic tutorial, *Hands-On Basic*, for more information; also see John Dickinson's column, "Basically Speaking" (p. 98) for a general discussion and treatment of Basic.

But reading from cassettes is clumsy and slow—we didn't enter the information age to use some old-style technology like the cassette recorder. There's none of this random access stuff with cassette tape—what the tape spews out is what you get, and you get it in the same order in which it appears on the tape.

If you really want to store information so that you can get it back again, floppy disks and disk drives are the way to go. If you want to ensure relative permanence of the information stored on your floppy disks, there are several things you should do to take care of them.

First, keep your disks clean. You know how grungy a dirty record sounds—a disk coated with dust, cigarette ash, or Pepsi Light plays even worse. You can always buy a new copy of a record, but data lost is sometimes lost forever. You wouldn't want to lose your list of itemized tax deductions, would you?

Okay, so don't leave disks on your dashboard, outside in Detroit in the winter, or next to phones that are apt to ring. And steer them clear of airport x-ray machines (the x-rays won't hurt you, but the magnetic fields might). Also, don't put your fingers through the ring in the center like you would with a 45 if you were being good, and don't put your hand over the sausage-shaped disk access hole, the way the model on our January cover did (do as we say, not as we illustrate). Don't wobble your disk as though it were a singing saw or use it as an impromptu fan.

Do keep your disks in their jackets (why is it there are always more floppies than jackets?), and tuck them away neatly when you're done with them.

Okay, Romper Room, let's proceed.

If you buy a program distributed by IBM for the PC*jr*, you'll find that it boots directly after you put the disk in the drive and turn the machine on (or hit control-alt-delete to reset the machine if it's already on). However, if you try the same thing with software from other

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Missing an installment of "Beginners' Corner"? The current column began in February 1984, but all back issues are still available; for further information, see page 4. The first "Beginners' Corner" columns (June 1982—September 1983) are now available as a single volume from Softalk Books.

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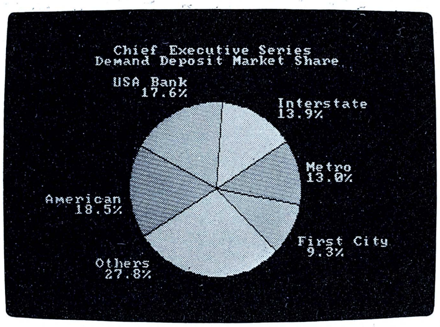

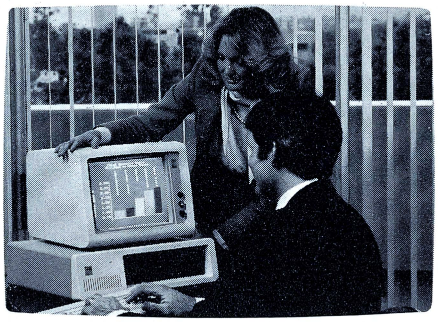

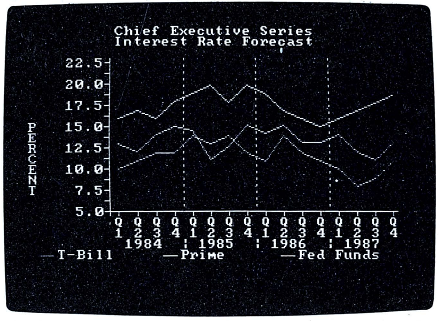

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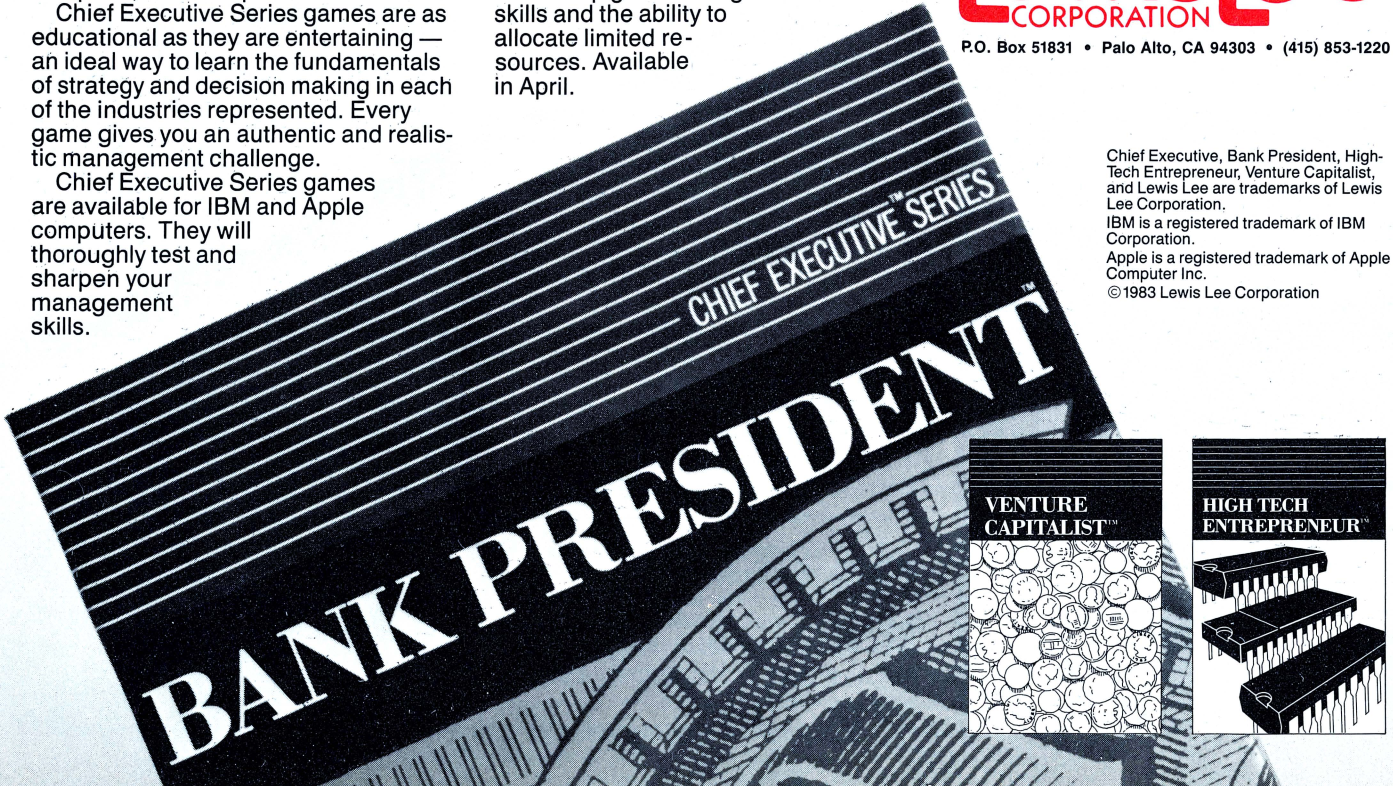


manufacturers, you may find that you get this:

Non-system disk or disk error
Replace and strike any key when ready

Why does this happen?

Because software from other manufacturers doesn't come with the operating system already on the disk; and without the operating system, you can't load a program from disk.

The operating system software creates an environment that allows a particular program to run on a particular machine; it acts as a liaison between the program and the computer's hardware.

The PC*jr*'s operating system is called DOS version 2.1; DOS stands for Disk Operating System. As you might have surmised, DOS tells Junior how to operate the disk drive so that information can be read from your disks or written onto your disks.

The reason you have to copy DOS to most non-IBM disks is that so-called third-party vendors (third party means other than you and other than IBM) are not permitted to sell DOS. You have to buy it from IBM and copy it to third-party software yourself. The third-party vendor should provide you with instructions to help you do that.

Some non-IBM programs—typically games—don't require you to load DOS. That's because these programs already incorporate some operating systems of their own. There are at least two reasons why a third-party program might have some operating system other than DOS. One is that the vendor simply prefers another operating system (the UCSD p-System is a relatively common alternative to DOS). Another reason is that a non-DOS operating system is one way a vendor might protect himself against would-be software thieves; disks that don't contain the standard operating system can't be copied in the standard way.

Speaking of copying—if your machine has a disk drive, one of the very first things you should do with it is make a backup copy of your DOS disk. This is the most important disk you have, since you need DOS in order to run almost all other programs.

Diskcopy. The simplest way to back up your DOS disk is to use the *diskcopy* command. This command is used to copy an entire disk. There's another command, called simply *copy*, that is used to copy individual files on a disk; you could use that command to make your backup copy, but it would be more complicated to do it that way.

Using *diskcopy* is easy. Just put your DOS disk in the drive and type

DISKCOPY

Once you've done that (and hit the enter key), you'll be prompted to insert the source disk and strike a key when ready. The source is the disk you want to copy. In this instance, your source disk *is* the DOS disk; on other occasions, when you're using *diskcopy* to back up your financial records, your word processing program, or some other important data, you'll remove DOS at this point and put in whatever disk it is you wish to copy.

When you strike a key, *diskcopy* will begin reading information from your source disk into memory. After a certain amount has been read from the source disk, you'll be prompted to insert the target disk—the disk you want to copy to. Once again, you'll strike a key when ready.

If at this point you get a message saying "formatting while copying," that's fine. If you don't, that's also fine. We'll discuss formatting shortly.

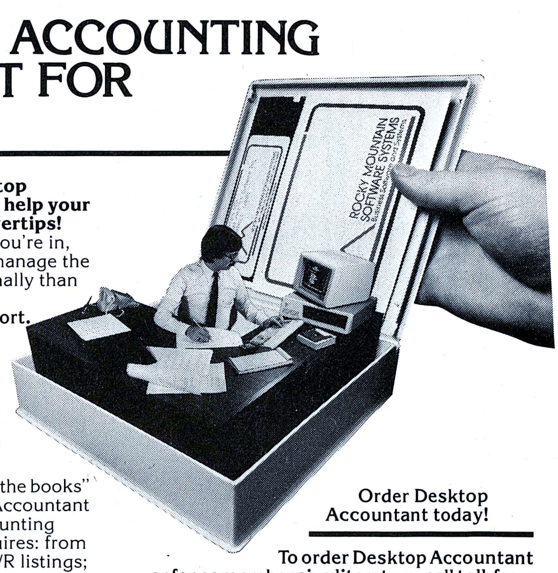
You'll be swapping your source and target disks five or six times in the course of the copying process. When *diskcopy* has finished its work, you'll be asked whether you wish to make another copy. It wouldn't hurt to make a second backup at this point—if you have another blank disk handy. In any case, signal your intention with the appropriate initial— Y or N—and *diskcopy* will take it from there. If your answer is no, you'll be back at the A> prompt.

Format. *Diskcopy* is only one of a dozen or so housekeeping utilities provided on your DOS disk. Probably the next one you should learn to use is *format*.

A blank disk fresh out of its packet is about as useful as a filing cabinet with no hanging files or folders. Before you can put any files on a disk, DOS has to mark the disk so that it can find its way around on it. The disk is marked (formatted) with concentric rings, called tracks; each track is further divided into sectors of equal size. DOS 2.1 uses nine sectors per track and forty tracks per disk side. The earliest versions of DOS— versions 1.0, 1.05, and 1.1—divided each track into eight sectors. DOS 2.0 was the first revision of the operating system to use nine-sector tracks.

The command that tells DOS to mark the disks with tracks and sectors is *format*. To use *format*, you have to have your copy of the DOS disk in the drive. (You did make a backup of your DOS disk, didn't you? And you've restored the original to the back of the DOS notebook?)

When you boot, you'll be asked for the date and time. It's tempting just to hit the enter key and power through this startup procedure, but keying in the date and time tells Junior what the time is so that your files can be stamped; this is one way you can tell when your files were created. But more about that later. When you enter the date, use either slashes or hyphens to separate month, day, and year; you only need to enter the last two digits of the



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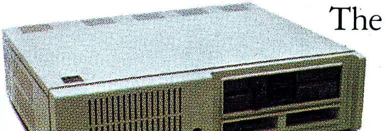

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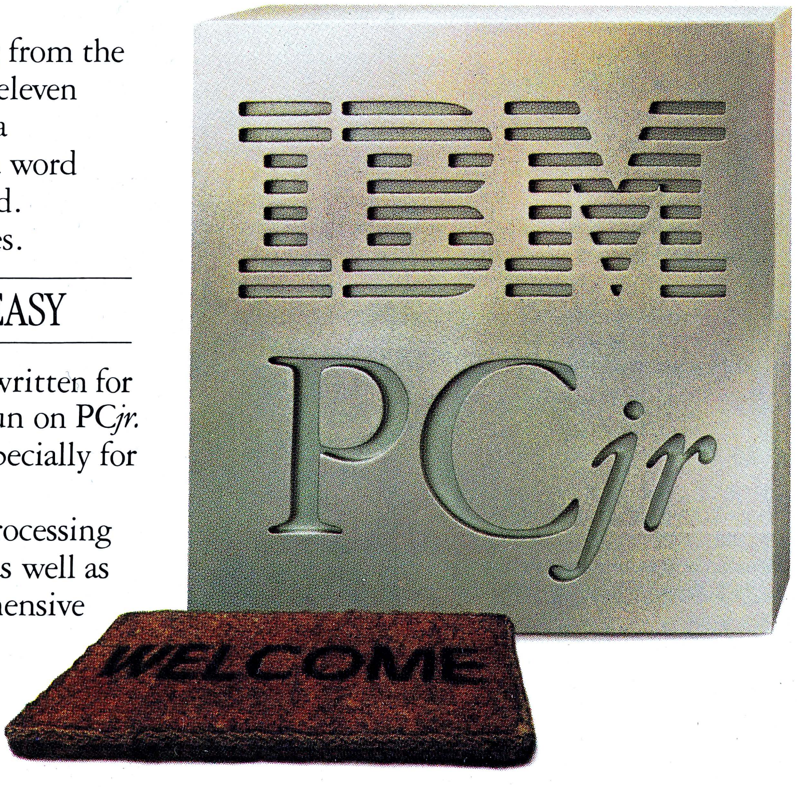

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year. When entering the time, use colons to separate hours from minutes and minutes from seconds. If you're a real stickler for precision, you can add a decimal point and the appropriate number of hundredths of seconds. You can be as precise or imprecise as you like; if you say the time is 3:15, DOS will assume you mean 3:15:00.00; in other words, it will tack on zeros wherever you leave off. One other thing: enter the p.m. hours as 13 through 24; DOS uses a twenty-four-hour clock (just like the Army).

Once you've got past the date and time, you can use the *format* command. To do that, just type *format* and hit the carriage return. DOS will tell you to

```
Insert new diskette for drive A:
and strike any key when ready
```

As it formats it'll run the message

```
Formatting...
```

When the formatting operation is complete, DOS will report how much room is available on the new disk for file storage. This message will look something like

```
362496 bytes total disk space
362496 bytes available on disk
```

You'll also be asked whether you want to format another disk. If you do, hit a Y for yes, and you'll be taken through the same procedure again. If you're through formatting, hitting N will get you back to the system prompt—A〉.

A disk formatted in the manner just described will be available for data storage. But it won't be a self-booting disk. You'll still get the "non-system disk" error message if you turn on the computer with such a disk in the drive. That's because certain vital files—known officially as IBMDOS.COM and IBMBIOS.COM—need to be present in order for a disk to be self-booting. The way to format a disk and make it self-booting at the same time is to type */s* after the word *format*, like so:

```
A〉FORMAT/S
```

There's one other wrinkle to the *format* command that you may find worth knowing: Junior can read eight-sector disks as well as nine-sector ones. But a PC running a version of DOS earlier than 2.0 won't be able to read a nine-sector disk. You need to be aware of this if you happen to use a PC at work and Junior at home. Fortunately, most PC systems by now are running DOS 2.0, and there's virtually no compatibility problem between DOS 2.0 and your Junior's DOS 2.1. But should you wish to format a disk on Junior that can be read by a DOS 1.1-running PC, you can use the /8 form of the *format* command. Type

```
FORMAT/8
```

and DOS will create an eight-sector-per-track disk for you.

Dir. When DOS formats or copies a disk, it creates a directory of the files on that disk; the directory helps it keep track of what's where on the disk. The directory, of course, also helps you keep track of what's on the disk. To look at a disk's directory, just put the disk in the drive and type

```
DIR
```

in response to the A〉 prompt. You'll see something like this:

```
GRAPHICS MAR     213340    1-31-84   3:24 p
TEMPLATE FEB        333    2-23-84   2:31 a
INVOICE  GTJ      79052    2-13-84   4:56 p
PARENTSL TTR        512    2-20-84   7:19 a
```

Each entry in this list represents a disk file; a disk file is simply a collection of information recognized by DOS as a single entity. Files may contain programs, data used by programs, or both.

Our sample disk directory lists four files. Their names are Graphics.mar, Template.feb, Invoice.gtj, and Parentsl.ttr. The number directly to the right of each filename indicates the size of each file; Template.feb, for example, is 333 bytes long; for all intents and purposes, you can consider that to mean 333 characters. The other two columns in the directory listing indicate the date and time when the file was created—or when it was last modified.

We'll look at some more DOS commands next month. ▲

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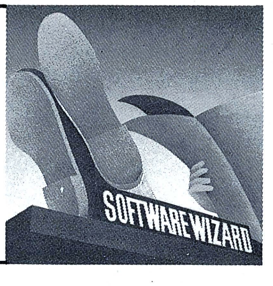

Δ **Persyst** (Irvine, CA) donated their Time Spectrum multifunction board and color display adapter boards to the Cerebral Palsy Telethon to automate the scheduling of the twenty-one-hour-long special aired January 14 and 15. This made it possible for a PC at the ABC studio in Los Angeles to communicate updated schedules and messages instantaneously to the production crew monitoring a PC at the CBS studio in New York City. "With this system in place we can react to any kind of revision in about two minutes," said **Larry Cohen**, production manager for the telethon. "The show flows much more smoothly."

Δ A Columbia VP portable computer, the 25,000th off the production line of **Columbia Data Products** (Columbia, MD), was awarded to **W. R. "Bob" Berg**, president of **Zepher Industries**, a Columbia distributor. The computer will supervise logistics for the Ultima Thule Mount Everest Expedition, of which Berg is a part. According to Berg, the expedition will follow the footsteps of the first ascent of Mount Everest by George Leigh-Mallory and will accomplish two main objectives—medical research and cultural exchange. "Columbia Data Products has always been a company that has set high goals," commented Columbia president **William Diaz**.

Δ A golden sun emitting a scanning laser beam that spelled the words "Corona Gives You More" was part of the demonstration program that won **Don Moir** of **Enterprise Computer Systems** (Jacksonville, FL) first prize in a **Corona Data Systems** (Westlake Village, CA) promotion. The contest objectives emphasized a demonstration of the graphics capabilities of the Corona PCs. Δ Corona recently signed an agreement valued in excess of $4 million with **Computer Systems Advisor** of Singapore. The Asian computer distributor will distribute the Corona Desktop PC and Portable PC in Singapore, Hong Kong, Malaysia, and Indonesia.

Δ **Eagle Computer** (Los Gatos, CA) has signed an agreement to provide IBM-compatible computers to **Thomson-CSF Communications** of France. Thomson-CSF will market the computers in France under a yet-to-be-announced brand name.

Δ **The Learning Company** (Menlo Park, CA), which already has IBM marketing its educational software—*Bumble Games*, *Juggles' Rainbow*, and *Bumble Plot*—for the PCjr, has also signed marketing agreements with **Simon & Schuster**, **Addison-Wesley**, and **American Express**. Simon & Schuster will sell the software products through major book outlets; Addison-Wesley will offer the software in special educational packages designed for classroom use; and American Express will offer six packages through its "Best of the Best" software catalog.

Δ **Ferrin Corporation** (San Francisco, CA), a personal computing support firm, believes that the "IBM XT/370 announcement will not be significant for most personal computer users. Most personal computer users will have nothing to do with the XT/370." However, **David Ferris**, Ferrin chairman, is more enthusiastic about the 3270-PC and expects its emulation of 3270 terminals to be popular among corporate users.

Δ **Ashton-Tate** (Culver City, CA) has announced the appointment of **Larry Benincasa** as vice president, new business development. Benincasa will direct the company's publications group and will establish a new educational/recreational book/software-publishing unit. Benincasa was previously publisher of computer-related books and software for Reston Publishing Company, a subsidiary of Prentice-Hall, where he was responsible for Prentice-Hall's first book on personal computing and its first piece of software. Δ **Norman H. Block** has been appointed executive vice president of finance administration for Ashton-Tate. Block will be responsible for planning and implementing long-term financial strategy, assisting in analysis of potential acquisitions, and managing the company's accounting, human resources, and legal services functions.

Δ **Quadram Corporation** (Norcross, GA) has become the first manufacturer of microcomputer products to advertise on national network

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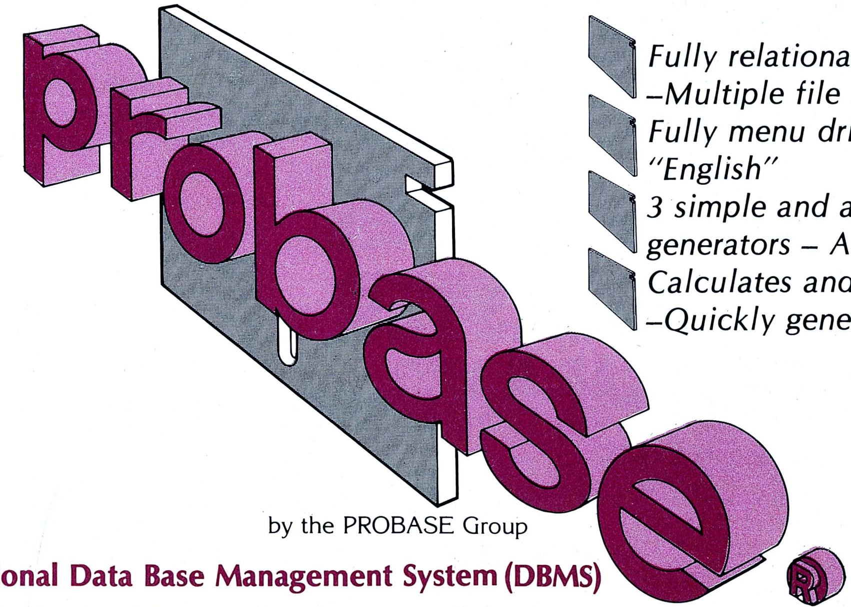

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television. Quadram's message, "We don't make computers, we make them better," is part of an ad campaign scheduled to run through April 22. Quadram is slotting the commercials primarily during news and information series—such as *60 Minutes* and the *CBS Evening News*. ΔQuadram held an open house recently to celebrate its new sixty-thousand-square foot building at 4355 International Boulevard in Norcross.

Δ **Xante Corporation** (Tulsa, OK) is testing its electronic software distribution system with mass merchandisers, as well as in Tulsa-area supermarkets and convenience stores. The software-by-wire system electronically transfers registered copies of software directly to the retail store; one game available for PC owners is *Revenge of the Beefsteak Tomatoes*. Many other titles will soon be available on the system.

Δ **Data Encore** (Sunnyvale, CA), a wholly owned subsidiary of **Verbatim Corporation**, recently appointed **Jean Ludwick** as national sales manager. Ludwick will be responsible for all sales activities including long-range sales and marketing planning and generation of sales revenues for the company's software duplication services. She most recently served as regional sales manager for Zytron Corporation in San Francisco.

Δ **Lotus Development Corporation** (Cambridge, MA) has appointed **Chuck Digate** as director of international operations, a new position. Digate comes to Lotus from Texas Instruments, where he was manager of the European home computer division.

Δ The *Microcom Networking Protocol (MNP)* won the Software Product of the Year award in the Second Annual Electronic Mail of the Year awards. *MNP*, designed by **Microcom** (Norwood, MA), allows personal computers to transfer files to other personal, mini, and mainframe computers.

Δ **PCExpo** (Englewood Cliffs, NJ) has been named as one of the top ten trade shows in the computer industry by *The Exhibit Reporter*, an industry newsletter. PCExpo was the only PC show to make the list.

Δ **Michael J. Daley** was recently named manager, finance and administration, of **Schuchardt Software Systems** (San Rafael, CA). Prior to joining the company, Daley was manager of taxation for MicroPro International.

Δ **Telford B. Sartell** has been named director of development at **Whitesmiths** (Concord, MA). He will be responsible for directing the company's product development activities and its R&D staff. Whitesmiths develops and markets C and Pascal compilers, cross compilers, as well as Idris, a Unix look-alike operating system for use on microcomputers.

Δ **Que Corporation** has moved to new offices: 7999 Knue Road, Suite 202, Indianapolis, IN 46250. ▲

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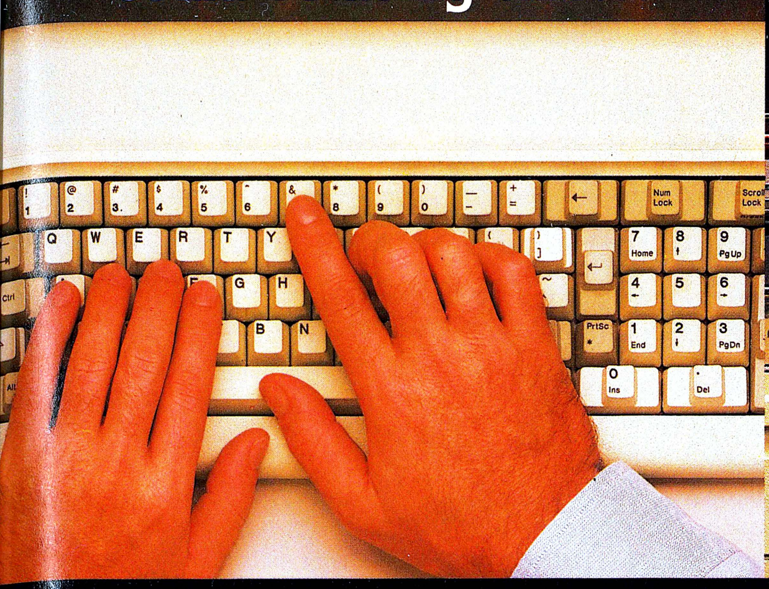

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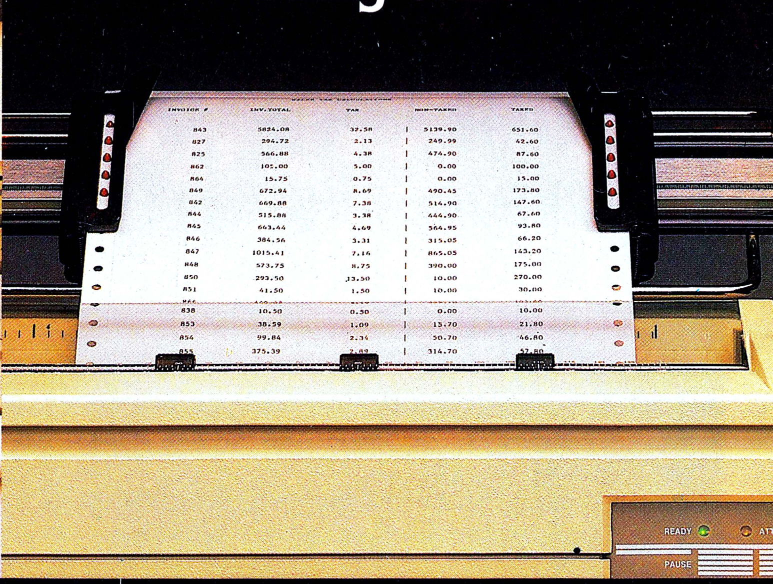

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FAST SORTING FROM BASIC

BY HOWARD GLOSSER

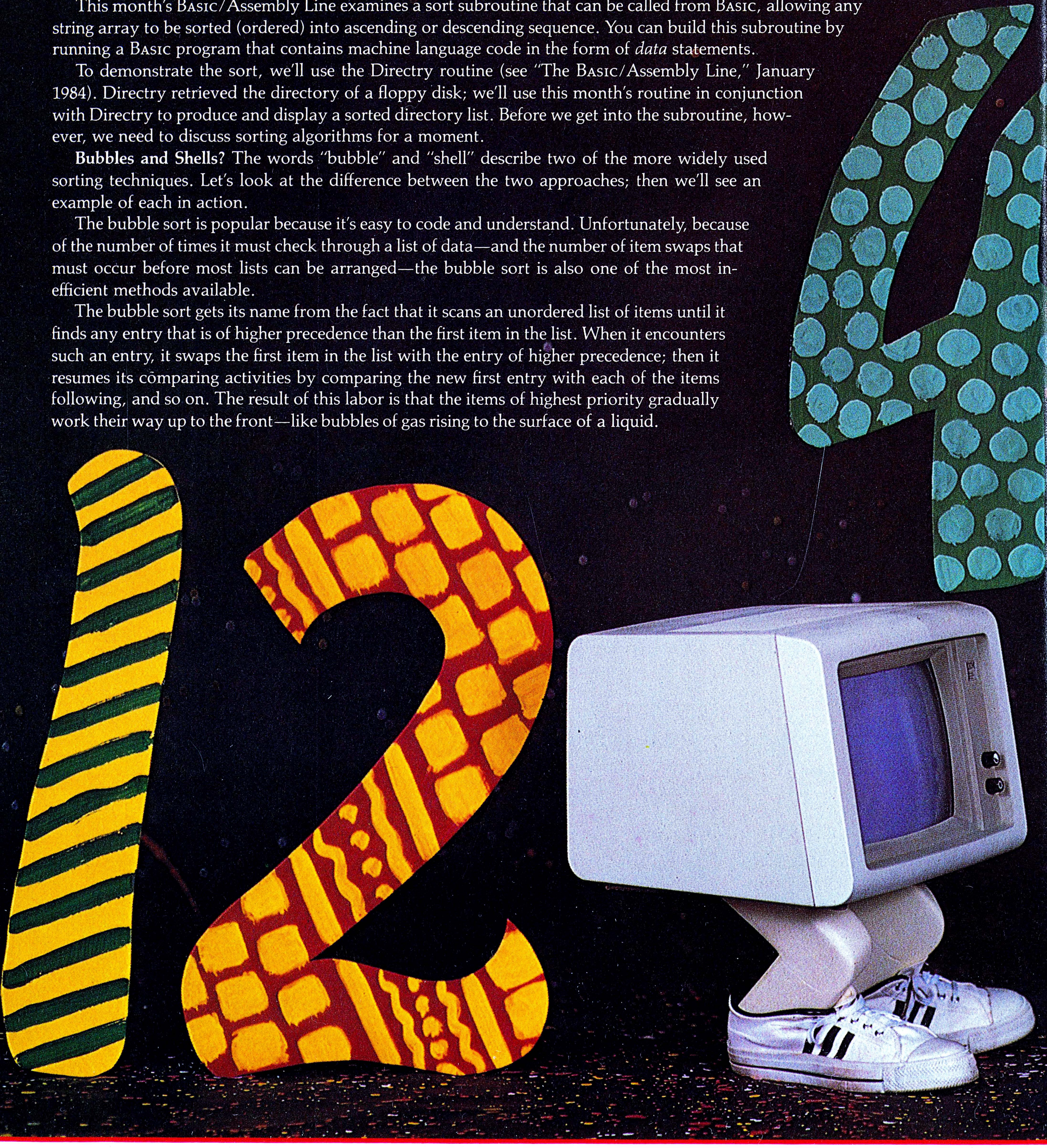
This month's Basic/Assembly Line examines a sort subroutine that can be called from Basic, allowing any string array to be sorted (ordered) into ascending or descending sequence. You can build this subroutine by running a Basic program that contains machine language code in the form of *data* statements.

To demonstrate the sort, we'll use the Directry routine (see "The Basic/Assembly Line," January 1984). Directry retrieved the directory of a floppy disk; we'll use this month's routine in conjunction with Directry to produce and display a sorted directory list. Before we get into the subroutine, however, we need to discuss sorting algorithms for a moment.

Bubbles and Shells? The words "bubble" and "shell" describe two of the more widely used sorting techniques. Let's look at the difference between the two approaches; then we'll see an example of each in action.

The bubble sort is popular because it's easy to code and understand. Unfortunately, because of the number of times it must check through a list of data—and the number of item swaps that must occur before most lists can be arranged—the bubble sort is also one of the most inefficient methods available.

The bubble sort gets its name from the fact that it scans an unordered list of items until it finds any entry that is of higher precedence than the first item in the list. When it encounters such an entry, it swaps the first item in the list with the entry of higher precedence; then it resumes its comparing activities by comparing the new first entry with each of the items following, and so on. The result of this labor is that the items of highest priority gradually work their way up to the front—like bubbles of gas rising to the surface of a liquid.



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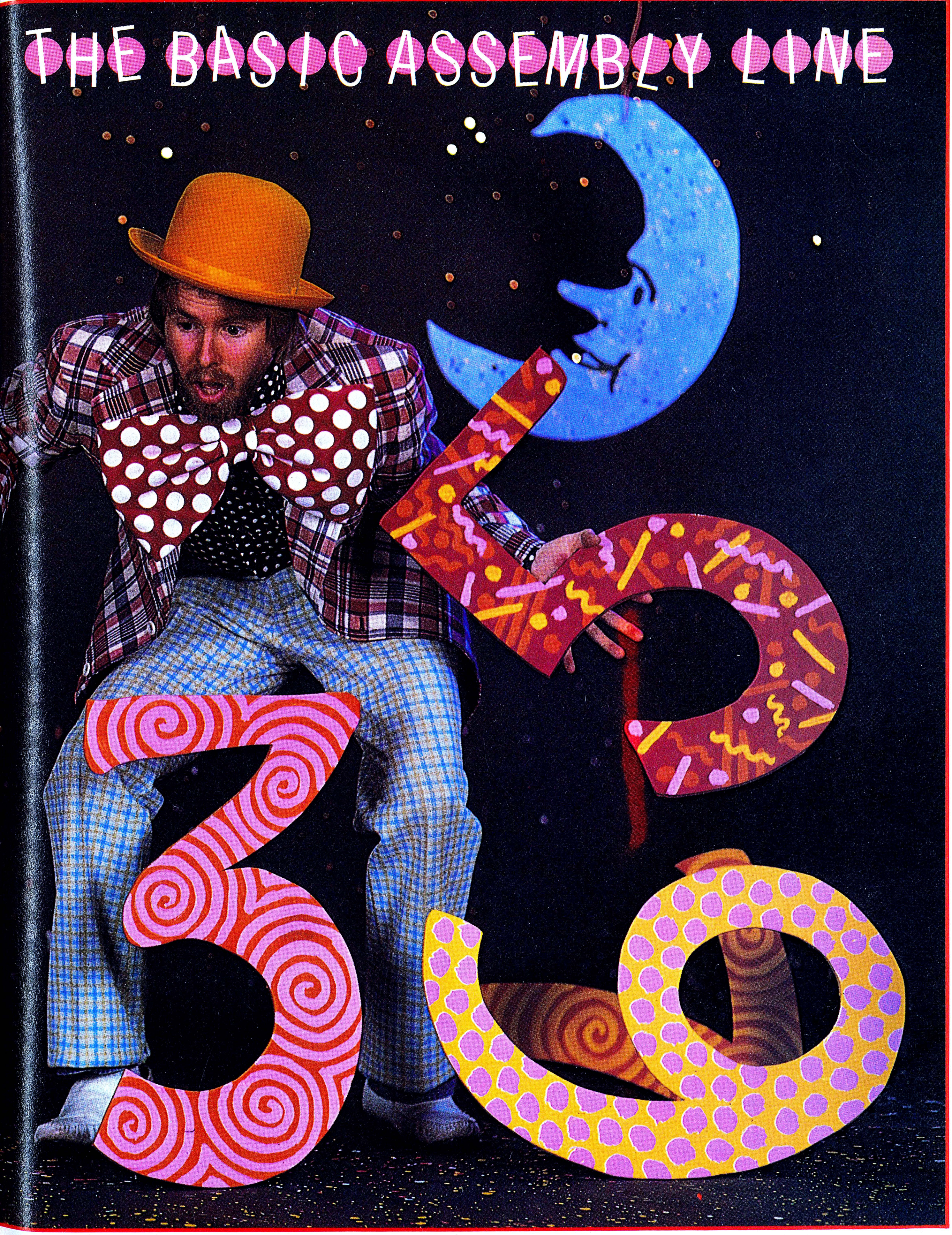

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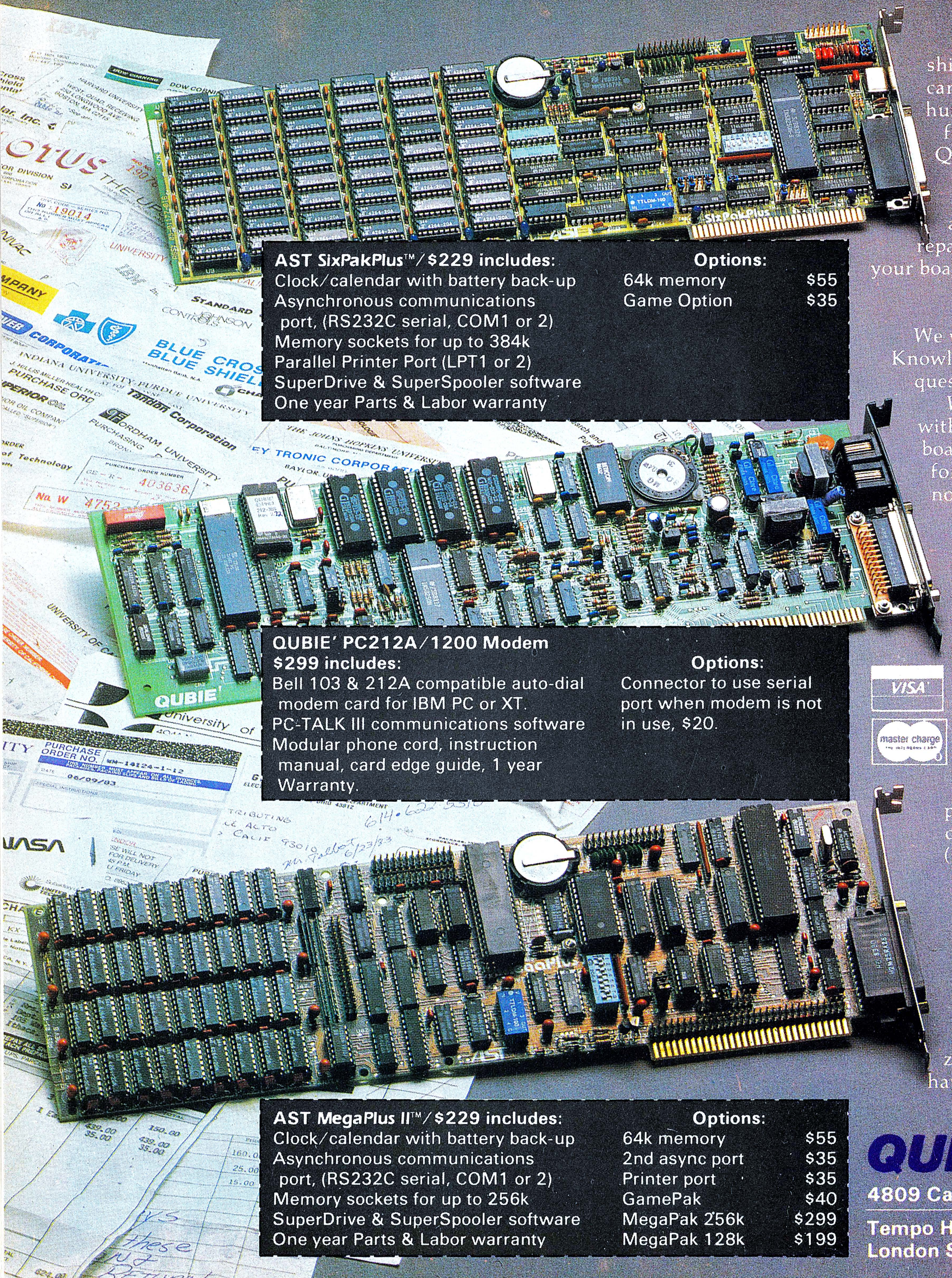

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Let's look at an example. Suppose we need to arrange the following set in ascending alphabetic sequence.

ENVY; POSITION-DEPENDENT_VARIABLES; SLOTH
PRIDE; COVETOUSNESS; LUST; ANGER; GLUTTONY

Here's how the bubble algorithm sorts this list. First, it compares ENVY to each other item in turn until it finds an entry with a lower ASCII value than ENVY—in this case until it comes to item 5, COVETOUSNESS. At this point it swaps ENVY and COVETOUSNESS, making the list look like this:

COVETOUSNESS; POSITION-DEPENDENT_VARIABLES
SLOTH; PRIDE; ENVY; LUST; ANGER; GLUTTONY

The algorithm continues by comparing COVETOUSNESS first with LUST, then with ANGER. Since ANGER's ASCII value is lower than that of COVETOUSNESS, these two items are swapped. Then ANGER is compared to GLUTTONY.

At this point the algorithm has completed its first pass through the list, ANGER has bubbled up to its proper position at the head of the list:

ANGER; POSITION-DEPENDENT_
VARIABLES; SLOTH
PRIDE; ENVY; LUST; COVETOUSNESS; GLUTTONY

Pass 2 begins with a comparison of the second entry—POSITION-DEPENDENT_VARIABLES—first to SLOTH, then to PRIDE, and then to ENVY. Since ENVY is of higher precedence than POSITION-DEPENDENT_VARIABLES, these two are swapped; the work then continues with the comparison of ENVY to LUST.

And so on until all entries are in their proper place. For lists that contain only a few entries, the bubble sort works great. But if you have a large number of items to sort, be prepared to wait awhile.

Introducing the Shell. The Shell-Metzner sort (hereafter we'll simply call it the Shell sort) works on the theory of divide and conquer. This algorithm compares widely separated elements first, eliminating large areas of disorder quickly, so that it has to do less swapping in the later stages. The overall result is that fewer exchanges need to be made.

The Shell algorithm starts by dividing our list of sins in half, forming two groups of four sins. Then it compares the first member of the first group (first in the original, unsorted, order) against the first member of the second, then the second member of the first group against the second member of the second, and so on. So, in its first pass, the Shell algorithm compares ENVY to COVETOUSNESS, POSITION-DEPENDENT_VARIABLES to LUST, SLOTH to ANGER, and PRIDE to GLUTTONY. After each comparison, items are swapped where appropriate.

The list after pass 1 looks like this:

COVETOUSNESS; LUST; ANGER; GLUTTONY
ENVY; POSITION-DEPENDENT_
VARIABLES; SLOTH; PRIDE

On pass 2, the list is divided into four parts, reducing the "gap" (the distance between compared items) by half. This time, COVETOUSNESS is compared to ANGER, LUST to GLUTTONY, and so on. Again, swaps are made where appropriate. At the end of pass 2, the list looks like this:

ANGER; GLUTTONY; COVETOUSNESS; LUST; ENVY
POSITION-DEPENDENT_VARIABLES; SLOTH; PRIDE

On pass 3, the list is further subdivided and the gap further reduced. This will be the last pass for our little list of peccadillos, because this time the gap is 1 — that is, this time each sin is compared to its immediate neighbor. Whenever a swap occurs on this pass, the algorithm checks to see if the item that was moved up (moved closer to the head of the list) should be swapped again—that is, swapped with its new neighbor on the left. In this way, whenever items are exchanged, all prior items are kept in proper sequence.

At the end of this pass, the list is in order.

A Basic Example. The Basic program listed in figure 1 demonstrates the bubble and Shell sort techniques. The program lists the elements of a string array before and after sorting and displays the number of swaps required to place the array into ascending sequence.

If you remove the comment marks at the front of lines 260 and 580, the program will display additional information concerning each comparison it performs. For the bubble sort it will show exactly which items are being compared; for the Shell sort, it will indicate the gap as well as the items being compared. The example will stop before each comparison, allowing you to study the logic and results. When you're ready to continue, hit F5.

Building a Shell Sort Subroutine. Figure 2 lists the Basic program that will build a Shell sort subroutine from machine code embedded in *data* statements. The program was designed to run on a 64K machine. If you have 96K or more, you should make the changes mentioned in the following paragraphs; these changes will load the subroutine into higher memory and leave more room in Basic's work area for your program.

The program uses a *def seg* statement in line 160 to define the memory segment where the subroutine is to be stored (if you have 96K or more, change line 160 to *def seg = &H1700*). Lines 170 through 230 poke the machine language code into the memory area addressed. Lines 270 through 310 perform a checksum on each data line to make sure the data has been keyed correctly. If the checksum routine uncovers an error, the message on line 340 is displayed; the message indicates which data line contains the error, and the program stops. If no errors are found, line 380 uses a *bsave* to store the subroutine on disk under the name Shellsrt.

Testing Shellsrt. We're going to use our sorting routine in conjunction with Directry, the subroutine that reads the directory of a floppy disk (see "The Basic/Assembly Line," January 1984). Unfortunately, as reader Timothy Martin of Griffith, Indiana, pointed out, that routine (and the Validate routine published the month before) uses a potentially dangerous programming procedure. A future Basic/Assembly Line article will address itself to this error and its correction, but in the meantime we offer here an amended version of Directry for use in conjunction with Shellsrt. Figure 3 includes the *data* statements necessary to produce the corrected subroutine, and figure 4 presents the modified assembler listing with comments.

Included along with January's subroutine was a Basic program to demonstrate how Directry worked. We'll add to that program this time, to produce a sorted directory.

If you've just joined us and don't have access to the January article, or if you just don't care for the idea of keying in a lot of Basic code, send your name, address, and a check for $8 to Softalk Sort, Box 7040, North Hollywood, CA 91603, and we'll send you a disk with the Basic programs to build both Directry and Shellsrt, as well as the Basic demonstration program for these subroutines.

Sorting a Directory. The program shown listed in figure 5 is a slightly modified version of the demonstration program listed in January. If you already have that routine, just make the following changes:

```
50 KEY OFF : CLEAR ,32768 'This CLEAR is only
     neces for 64K systems
70 SUBRT$ = STRING$(113,32)
410 DEF SEG : LOCATE ,,0 : GOSUB 550
470 PRINT "Sorted directory of drive " DRV$ ": contains " COUNT%
     "entries "
480 PRINT : GOSUB 750 'Go sort the directory
```

Lines 740 through 880 in the listing are new and consist of the code to load and call the Shellsrt subroutine. Since the example can be run more than once, variable ShellD% is used in line 770 to keep track of whether the subroutine has been previously loaded.

Line 780 uses a *def seg* to define the segment where Shellsrt is to be loaded, and line 790 loads the subroutine into memory.

Notice the *gosub 750* that was added to line 480 (the line before the directory is to be displayed on the screen). This *gosub* references the routine in lines 820 through 880, where the call to Shellsrt occurs. Because the Directry subroutine resides in one area of memory and Shellsrt in another, each time either subroutine is called, the proper memory segment must be addressed. This is handled by the *def seg* added to line 410 (which points to Basic's data segment) and by the *def seg* on line 850, which points to &HF00 (if your machine has 96K or more, substitute *def seg = &H1700* on lines 780 and 850).

Line 860 contains the variable Seq$, which is one of the parameters passed to Shellsrt, telling the routine whether your array is to be sorted into ascending or descending order. An "a" on line 860 will cause the directory list to appear in ascending sequence, while a "d" will result in a descending sort. In both cases uppercase and lowercase input are equally acceptable. The call to Shellsrt in line 870 includes the sequence indicator (Seq$), the number of entries to be sorted (Count%), and the lowest array entry (Dirlst$(0)).

When you run the program, you'll be prompted for the letter of the drive whose directory is to be read. After the directory has been read (by means of the Directry subroutine), the entries in the array Dirlst$ are sorted and the sorted directory list is displayed.

The uses for Shellsrt are as varied as the uses for the PC itself. Names, phone numbers, record codes, addresses, dollar amounts, zip codes, and yes, even directory lists—there's always some data that needs sorting before it can be displayed or stored.

According to Hoyle.... Here are the rules governing use of the Shellsrt subroutine:

1. The routine works with string arrays only.
2. The sequence code must be either "a" or "d" (in either capital or small letters). The default is ascending.
3. Entries of varying lengths can be used in the string array.
4. The call to Shellsrt must contain the sort sequence code, number of entries to be sorted, and the beginning entry of the array, and this information *must* be supplied in the order shown.
5. Because of the way string space is handled by the Basic Compiler, Shellsrt will not operate in compiled Basic.
6. If the count of array entries passed to Shellsrt does not match the actual number of array entries, results will be unpredictable.

Now that we've seen some examples and covered the rules for using Shellsrt, let's take a look at the assembly language that generates this subroutine.

The Shellsrt Assembly. Figure 6 is the commented assembler listing for Shellsrt. In studying this program, you might find it useful to refer to Appendix I of the Basic manual; there's a discussion there of string descriptors, which are the key to Shellsrt.

The subroutine begins by defining some variables used within the program. Since the string descriptors for each element of a string array are stored in order in memory (three bytes each), an INDEX must be kept for the string descriptor currently in use. The program simply sorts the string descriptors (not their contents), based upon the ASCII sequence of the detail they point to. This is what gives the routine its sorting speed. At any one time only three bytes of data need to be moved, even if the data itself is actually sixty-four characters long.

The variable GAP refers to the distance between the two items being compared. INTRVL refers to the higher number of the entry set being compared at a particular time. For example, if entries 2 and 6 are being compared, the value of INTRVL is 6. The LEN1 and LEN2 fields are used to keep track of the lengths of the two entries undergoing comparison; this enables the CMPSB instruction on line 134 to use the length of the shorter one.

The actual program begins on line 26, where passed information from the Basic program is retrieved in regard to sequence, count of entries to sort, and location of the array. The sort proceeds by figuring the GAP and the INTRVL, comparing the contents of the two string descriptors figured by INTRVL and INDEX, and swapping the string descriptors if necessary (depending on the sequence chosen). SRTWORK is used as an intermediate work field throughout this operation.

→

```
10 '
20 ' **** An Example of BUBBLE and SHELL Sorts ****
30 '
40 '   Remove the comment mark on lines
50 '   260 and 580 to see the operation
60 '   of each sort step by step.
70 '
80 KEY OFF
90 CLS
100 CNT% = 8
110 '
120 ' ** FILL ARRAY
130 '
140 FOR X = 1 TO CNT%
150   READ DTA$
160   A$(X) = DTA$
170 NEXT
180 '
190 ' **** BUBBLE SORT
200 '
210 PRINT " Example of BUBBLE sort" : PRINT : PRINT "Before. . .  ";
220 GOSUB 760
230 '
240 FOR ITEM = 1 TO CNT% - 1
250   FOR ITEM2 = ITEM + 1 TO CNT%
260 '     PRINT : PRINT "ITEM = " ITEM " ITEM2 = " ITEM2 : GOSUB 740 : STOP
270       IF A$(ITEM) > A$(ITEM2) THEN SWAP A$(ITEM2),A$(ITEM) : SWP% = SWP% + 1
280   NEXT
290 NEXT
300 '
310 PRINT : PRINT "After. . .  ";
320 GOSUB 760
330 PRINT : PRINT : PRINT "Number of swaps during BUBBLE sort = " SWP%
340 SWP% = 0 : RESTORE
350 PRINT : PRINT STRING$(72,205)
360 '
370 ' ** FILL ARRAY AGAIN
380 '
390 FOR X = 1 TO CNT%
400   READ DTA$
410   A$(X) = DTA$
420 NEXT
430 PRINT "Press any key for SHELL sort. . ." : BEEP
440 CN$ = INKEY$ : IF CN$ = "" THEN 440
450 '
460 ' **** SHELL SORT
470 '
480 PRINT : PRINT " Example of SHELL sort" : PRINT : PRINT "Before. . .  ";
490 GOSUB 760 : PRINT
500 '
510 GAP = CNT% / 2
520 WHILE INT(GAP) > 0
530   INTERVAL = GAP + 1
540   WHILE INTERVAL <= CNT%
550    ITEM = INTERVAL - GAP
560    WHILE ITEM > 0
570     ITEM2 = ITEM + GAP
580 '    PRINT "GAP= " GAP " ITEM = " ITEM " ITEM2 = " ITEM2 : GOSUB 740 : STOP
590     IF A$(ITEM) > A$(ITEM2) THEN SWAP A$(ITEM),A$(ITEM2) : ITEM = ITEM - GAP : SWP% = SWP% + 1 : ELSE ITEM = 0
600    WEND
610    INTERVAL = INTERVAL + 1
620   WEND
630   GAP = GAP / 2
640 WEND
650 '
660 PRINT "After. . .  ";
670 GOSUB 760
680 PRINT : PRINT : PRINT "Number of swaps during SHELL Sort  = " SWP%
690 SOUND 500,1 : SOUND 400,1
700 END
710 '
720 DATA ENVY,POSITION-DEPENDENT_VARIABLES,SLOTH,PRIDE,COVETOUSNESS,LUST,ANGER,GLUTTONY
730 '
740 ' **** ROUTINE TO PRINT CONTENTS OF ARRAY
750 '
760 FOR X = 1 TO 8
770   PRINT A$(X) " ";
780 NEXT
790 RETURN
```

Figure 1.

```
10 '  ***** SHELL SORT *****
20 '
30 '  This subroutine sorts any STRING array in
40 '  ascending or descending sequence, within a BASIC program
50 '
60 '  WRITTEN BY HOWARD GLOSSER
70 '
80 ' ***** THIS BUILDS AND CHECKS THE SUBROUTINE
90 '
100 CLS
110 PRINT "Creating SHELL SORT Subroutine. . ." : PRINT
120 '
130 CHECKCNT% = 0
140 LINENO% = 440
150 '
160 DEF SEG = &HF00  ' Use def seg = &H1700 for machines with 96K or more
170 FOR MEM% = 0 TO 367
180    READ DT%
190    IF CHECKCNT% = 8 THEN GOSUB 270
200    POKE MEM%,DT%
210    CHECKSUM% = CHECKSUM% + DT%
220    CHECKCNT% = CHECKCNT% + 1
230    GOTO 320
240 '
250 ' ** THIS PERFORMS CHECKSUM BY LINE
260 '
270    IF CHECKSUM% <> DT% THEN 340
280    LINENO% = LINENO% + 10
290    CHECKCNT% = 0 : CHECKSUM% = 0
300    READ DT%
310    RETURN
320 NEXT
330 GOTO 380
340 PRINT "ERROR in DATA STATEMENT - Check line " LINENO% : END
350 '
360 ' ***** THIS SAVES THE SUBROUTINE
370 '
380 BSAVE "SHELLSRT",0,364
390 PRINT "SHELL SORT SUBROUTINE CREATED"
400 END
410 '
420 ' ***** DATA STATEMENTS TO BUILD SUBROUTINE
430 '
440 DATA  235,   18,   32,    0,    0,   32,   32,   32,   381
450 DATA    0,    0,    0,    0,    0,    0,    0,    0,     0
460 DATA    0,    0,    0,    0,   85,  139,  236,   46,   506
470 DATA  199,    6,    8,    0,    0,    0,  139,  118,   470
480 DATA    8,  139,    4,   61,    2,    0,  124,   42,   380
490 DATA   46,  163,    8,    0,  139,   94,    6,   46,   502
500 DATA  137,   30,    3,    0,  139,   94,   10,  139,   552
510 DATA  119,    1,  139,    4,   37,  223,    0,   61,   584
520 DATA   68,    0,  117,    6,   46,  162,    2,    0,   401
530 DATA  235,   12,   46,  198,    6,    2,    0,   65,   564
540 DATA  235,    4,   93,  202,    6,    0,   46,  161,   747
550 DATA    8,    0,   46,  163,   12,    0,   46,  209,   484
560 DATA   46,   12,    0,  116,  237,   46,  161,   12,   630
570 DATA    0,   46,  163,   14,    0,   46,  161,   14,   444
580 DATA    0,   46,   59,    6,    8,    0,  125,  230,   474
590 DATA  232,  207,    0,   46,  161,   14,    0,   46,   706
600 DATA   43,    6,   12,    0,   46,  163,   10,    0,   280
610 DATA  232,   93,    0,  156,   46,  128,   62,    2,   719
620 DATA    0,   65,  117,    6,  157,  115,   36,  235,   731
630 DATA    4,  144,  157,  118,   30,   46,  161,   10,   670
640 DATA    0,  185,    3,    0,  247,  225,   46,    3,   709
650 DATA    6,    3,    0,  139,  240,  232,  126,    0,   746
660 DATA   46,  161,   12,    0,   46,   41,    6,   10,   322
670 DATA    0,  125,  205,   46,  141,   54,    5,    0,   576
680 DATA   46,  161,   10,    0,   46,    3,    6,   12,   284
690 DATA    0,  185,    3,    0,  247,  225,   46,    3,   709
700 DATA    6,    3,    0,  139,  248,  185,    3,    0,   584
710 DATA   30,  140,  200,  142,  216,  252,  243,  164,  1387
720 DATA   31,   46,  255,    6,   14,    0,  235,  133,   720
730 DATA   46,  161,   10,    0,  185,    3,    0,  247,   652
740 DATA  225,   46,    3,    6,    3,    0,  139,  216,   638
750 DATA  139,   15,   46,  137,   14,   16,    0,  139,   506
760 DATA   71,    1,  139,  248,   46,  141,   30,    5,   681
770 DATA    0,   30,  140,  200,  142,  216,  139,   15,   882
780 DATA   46,  137,   14,   18,    0,  139,  119,    1,   474
790 DATA   31,   46,  139,   14,   16,    0,   46,  161,   453
800 DATA   18,    0,   59,  200,  127,    2,  235,    2,   643
810 DATA  139,  200,  252,  243,  166,  195,   46,  161,  1402
820 DATA   10,    0,   46,    3,    6,   12,    0,  185,   262
830 DATA    3,    0,  247,  225,   46,    3,    6,    3,   533
840 DATA    0,  139,  248,  185,    3,    0,  252,  243,  1070
850 DATA  164,  195,   46,  161,   14,    0,  185,    3,   768
860 DATA    0,  247,  225,   46,    3,    6,    3,    0,   530
870 DATA  139,  240,   46,  141,   62,    5,    0,  185,   818
880 DATA    3,    0,    6,  140,  200,  142,  192,  252,   935
890 DATA  243,  164,    7,  195,    0,    0,    0,    0,   609
```

Figure 2.

```
10 '  ***** BUILD DIRECTRY *****
20 '     (modified version)
30 '  RETRIEVE A DISKETTE'S DIRECTORY
40 '     FROM WITHIN A BASIC PROGRAM
50 '
60 '  WRITTEN BY HOWARD GLOSSER
70 '
80 CLS
90 PRINT "Creating DIRECTRY subroutine. . ." : PRINT
100 '
110 ' ** THIS SETS UP STRING LOCATION FOR SUBROUTINE
120 '
130 DEF SEG
140 SUBRT$ = STRING$(120,32)
150 SUBLC% = VARPTR(SUBRT$)
160 DRCT = PEEK(SUBLC% + 1) + PEEK(SUBLC% + 2) * 256
170 LCN = DRCT
180 '
190 ' ** THIS BUILDS THE SUBROUTINE
200 '
210 LINENO% = 450
220 FOR STMT = 1 TO 15
230   FOR MEM = 1 TO 8
240     READ DT%
250     POKE LCN,DT%
260     CHECKSUM% = CHECKSUM% + DT%
270     LCN = LCN + 1
280   NEXT
290   READ DT%
300   IF CHECKSUM% <> DT% THEN 410
310   LINENO% = LINENO% + 10
320   CHECKSUM% = 0
330 NEXT
340 '
350 ' ** THIS SAVES THE SUBROUTINE
360 '
370 BSAVE "DIRECTRY",DRCT,113
380 PRINT "DIRECTRY SUBROUTINE CREATED"
390 END
400 '
410 PRINT "ERROR in DATA STATEMENT - Check line " LINENO% : END
420 '
430 ' ** STATEMENTS TO BUILD SUBROUTINE
440 '
450 DATA   85,  139,  236,  139,   94,   14,  139,  119,   965
460 DATA    1,  139,    4,   53,   64,    0,  139,   94,   494
470 DATA   12,  139,  127,    1,  136,    5,   87,   71,   578
480 DATA  176,   63,  185,   11,    0,  243,  170,  139,   987
490 DATA   94,   10,  139,   87,    1,  139,  250,  180,   900
500 DATA   26,  205,   33,  139,   94,    8,   67,   90,   662
510 DATA   85,   51,  237,  180,   17,  205,   33,   60,   868
520 DATA  255,  116,   18,   69,  232,   25,    0,  180,   895
530 DATA   18,  205,   33,   60,  255,  116,    6,   69,   762
540 DATA  232,   13,    0,  226,  242,  149,   93,  139,  1094
550 DATA  126,    6,  137,    5,   93,  202,   10,    0,   579
560 DATA  139,  247,   87,  139,   63,  131,  195,    3,  1004
570 DATA   70,  185,    8,    0,  243,  164,  198,    5,   873
580 DATA   46,   71,  185,    3,    0,  243,  164,   95,   807
590 DATA  195,    0,    0,    0,    0,    0,    0,    0,   195
```

Figure 3.

The compares and swaps continue until INTRVL becomes equal to the number of array entries, at which time GAP is divided in half and, if the result is not 0, the process is repeated.

The subroutine ends on line 50 with a far return to Basic.

Let's Hear from You. What are your thoughts about and reactions to the Basic/Assembly Line series? If you have a comment, suggestion, or idea for a subroutine, or if you've expanded upon one of the routines in this series, please write to Basic/Assembly Line, Softalk/IBM, Box 7040, North Hollywood, CA 91603.

Next installment: a subroutine that returns the amount of space available on a disk. ▲

```
                        ; DIRECTRY (modified)
                        ;
                        ; THIS ROUTINE WILL ACCESS A
                        ; DISKETTE'S DIRECTORY AND IS CALLED FROM BASIC
                        ;
                        ; WRITTEN BY HOWARD GLOSSER
                        ;
0000                    CSEG        SEGMENT
                                    ASSUME CS:CSEG
0000                    DIRECTRY    PROC   FAR
0000    55                          PUSH   BP                  ;SAVE BP FOR FAR RETURN
0001    8B EC                       MOV    BP,SP               ;MOVE STACK POINTER TO BP
0003    8B 5E 0E                    MOV    BX,[BP]+14          ;POINT BX AT PARM 1
0006    8B 77 01                    MOV    SI,1[BX]            ;GET DRIVE
0009    8B 04                       MOV    AX,[SI]             ;MOVE DRIVE LETTER TO AX
000B    35 0040                     XOR    AX,40H              ;CONVERT LETTER TO NUMBER
000E    8B 5E 0C                    MOV    BX,[BP]+12          ;POINT BX AT PARM 2
0011    8B 7F 01                    MOV    DI,1[BX]            ;GET FCB AREA
0014    88 05                       MOV    BYTE PTR [DI],AL    ;PUT DRIVE NUMBER IN FCB
0016    57                          PUSH   DI                  ;SAVE FCB AREA
0017    47                          INC    DI                  ;BUMP DI PAST DRIVE NUMBER
0018    B0 3F                       MOV    AL,'?'              ;PUT ? IN AL FOR STOSB
001A    B9 000B                     MOV    CX,11               ;LENGTH OF NAME/EXT
001D    F3/ AA                      REP    STOSB               ;FILL NAME/EXT WITH 11 '?'
001F    8B 5E 0A                    MOV    BX,[BP]+10          ;POINT BX AT PARM 3
0022    8B 57 01                    MOV    DX,1[BX]            ;GET DTA AREA
0025    8B FA                       MOV    DI,DX               ;SAVE DTA ADDRESS IN DI
0027    B4 1A                       MOV    AH,1AH              ;SET AH FOR DTA FUNCTION CALL
0029    CD 21                       INT    21H                 ;DOS INTERRUPT
002B    8B 5E 08                    MOV    BX,[BP]+8           ;POINT BX AT PARM 4
002E    43                          INC    BX                  ;POINT TO DIRLST() ADDRESS
002F    5A                          POP    DX                  ;PUT FCB ADDRESS IN DX
0030    55                          PUSH   BP                  ;SAVE BP REGISTER
0031    33 ED                       XOR    BP,BP               ;CLEAR BP/USE FOR ENTRY COUNTER
0033    B4 11                       MOV    AH,11H              ;SET AH FOR DIRECTORY SEARCH
0035    CD 21                       INT    21H                 ;DOS INTERRUPT
0037    3C FF                       CMP    AL,0FFH             ;ANY MATCHES FOUND?
0039    74 12                       JE     DONE                ;NO - DIRECTORY IS EMPTY
003B    45                          INC    BP                  ;YES - COUNT FIRST ENTRY
003C    E8 0058 R                   CALL   MOVE                ;GO MOVE ENTRY TO DIRLST()
003F                    DIRLOOP:
003F    B4 12                       MOV    AH,12H              ;SET AH FOR SUBSEQUENT SEARCH
0041    CD 21                       INT    21H                 ;DOS INTERRUPT
0043    3C FF                       CMP    AL,0FFH             ;ANY MATCHES FOUND?
0045    74 06                       JE     DONE                ;NO - WE ARE DONE
0047    45                          INC    BP                  ;YES - COUNT ENTRY
0048    E8 0058 R                   CALL   MOVE                ;GO MOVE ENTRY TO DIRLST()
004B    E2 F2                       LOOP   DIRLOOP             ;DO AGAIN
004D                    DONE:
004D    95                          XCHG   AX,BP               ;MOVE ENTRIES COUNT TO AX
004E    5D                          POP    BP                  ;RESTORE BP REGISTER
004F    8B 7E 06                    MOV    DI,[BP]+6           ;GET ADDRESS OF COUNT%
0052    89 05                       MOV    [DI],AX             ;PUT ENTRY COUNT IN COUNT%
0054    5D                          POP    BP                  ;RESTORE BP
0055    CA 000A                     RET    10                  ;FAR RETURN WITH 5 PARMS
0058                    DIRECTRY    ENDP
                        ;
0058                    MOVE        PROC   NEAR
0058    8B F7                       MOV    SI,DI               ;PUT DTA ADDRESS IN SI
005A    57                          PUSH   DI                  ;SAVE DTA ADDRESS
005B    8B 3F                       MOV    DI,[BX]             ;POINT DI AT DIRLST()
005D    83 C3 03                    ADD    BX,3                ;BUMP TO NEXT DESCRIPTOR ADDRESS
0060    46                          INC    SI                  ;BUMP SI PAST DRIVE NUMBER
0061    B9 0008                     MOV    CX,8                ;LENGTH OF NAME
0064    F3/ A4                      REP    MOVSB               ;MOVE NAME INTO DIRLST()
0066    C6 05 2E                    MOV    BYTE PTR [DI],'.'   ;PUT '.' IN FILENAME
0069    47                          INC    DI                  ;BUMP PAST '.'
006A    B9 0003                     MOV    CX,3                ;LENGTH OF EXTENSION
006D    F3/ A4                      REP    MOVSB               ;MOVE EXTENSION INTO DIRLST()
006F    5F                          POP    DI                  ;RESTORE DTA ADDRESS TO DI
0070    C3                          RET                        ;END 'MOVE' SUBROUTINE
0071                    MOVE        ENDP
0071                    CSEG        ENDS
```

Figure 4.

```
10 ' ***** THIS PROGRAM DEMONSTRATES DIRECTRY *****
20 '
30 '  **** STORE DIRECTRY SUBROUTINE IN STRING
40 '
50 KEY OFF : CLEAR ,32768! 'This CLEAR is only necessary for 64K systems
60 DEF SEG
70 SUBRT$ = STRING$(113,32)
80 SUBLC% = VARPTR(SUBRT$)
90 GOSUB 550
100 BLOAD "DIRECTRY",DIRECT
110 '
120 ' ** DEFINE CONSTANTS NECESSARY IN PROGRAM
130 '
140 DIM DIRLST$(111)
150 FCB$ = STRING$(33,32)
160 DTA$ = STRING$(33,32)
170 FILLER$ = STRING$(12,32)
180 COUNT% = 0
190 '
200 ' ** SET DIRLST(0) TO BLANKS
210 '
220 FOR LOOP% = 0 TO 111 : DIRLST$(LOOP%) = FILLER$ : NEXT
230 '
240 CLS
250 '
260 ' ** SELECT DRIVE FOR READING DIRECTORY
270 '
280 LOCATE 1,20
290 PRINT "*** DEMONSTRATE DIRECTRY SUBROUTINE ***"
300 LOCATE 3,10,1
310 PRINT "Specify drive letter for directory (A B C D) : ";
320 GOSUB 610 : DRV$ = KY$
330 '
340 ' ** FIND OUT IF DRIVE LETTER IS VALID
350 '
360 HIT% = INSTR("ABCD",DRV$)
370 IF HIT% = 0 THEN SOUND 50,7 : GOTO 300 ELSE PRINT DRV$
380 '
390 '** CALL TO DIRECTRY SUBROUTINE
400 '
410 DEF SEG : LOCATE ,,0 : GOSUB 550
420 CALL DIRECT (DRV$,FCB$,DTA$,DIRLST$(0),COUNT%)
430 '
440 ' ** LIST RESULTS OF DIRECTRY CALL
450 '
460 LOCATE 5,10
470 PRINT "Sorted directory of drive " DRV$ ": contains " COUNT% " entries "
480 PRINT : GOSUB 750 'Go sort the directory
490 FOR LOOP = 0 TO COUNT% - 1 : PRINT DIRLST$(LOOP) SPC(6); : NEXT : PRINT
500 PRINT : PRINT "Press SPACE BAR to continue or (S) to Stop "
510 BEEP
520 GOSUB 610 : CN$ = KY$
530 IF CN$ = "S" THEN END
540 GOTO 180
550 '
560 ' ** RETRIEVE LOCATION OF SUBROUTINE
570 '
580 DIRECT = PEEK(SUBLC% + 1) + PEEK(SUBLC% + 2) * 256
590 RETURN
600 '
610 ' **** KEY IN ROUTINE
620 '
630 KY$ = INKEY$ : IF KY$ = "" THEN 630
640 '
650 ' ** CHECK FOR SMALL OR CAPITAL LETTERS
660 '
670 IF KY$ < CHR$(97) OR KY$ > CHR$(122) THEN 730
680 '
690 ' ** CHANGE LOWERCASE TO UPPERCASE
700 '
710 KY$ = CHR$(ASC(KY$) - 32)
720 '
730 RETURN
740 '
750 ' **** SHELL SORT SECTION
760 '
770 IF SHELLD% = 1 THEN 850
780 DEF SEG = &HF00 ' Use def seg = &H1700 for machines with 96K or more
790 BLOAD "SHELLSRT",0
800 SHELLSRT = 0
810 SHELLD% = 1
820 '
830 ' ** CALL TO SHELLSRT SUBROUTINE
840 '
850 DEF SEG = &HF00  ' Use def seg = &H1700 for machines with 96K or more
855 '
860 SEQ$ = "A"        ' Change this to "D" for descending sequence
865 '
870 CALL SHELLSRT (SEQ$,COUNT%,DIRLST$(0))
880 RETURN
```

Figure 5.

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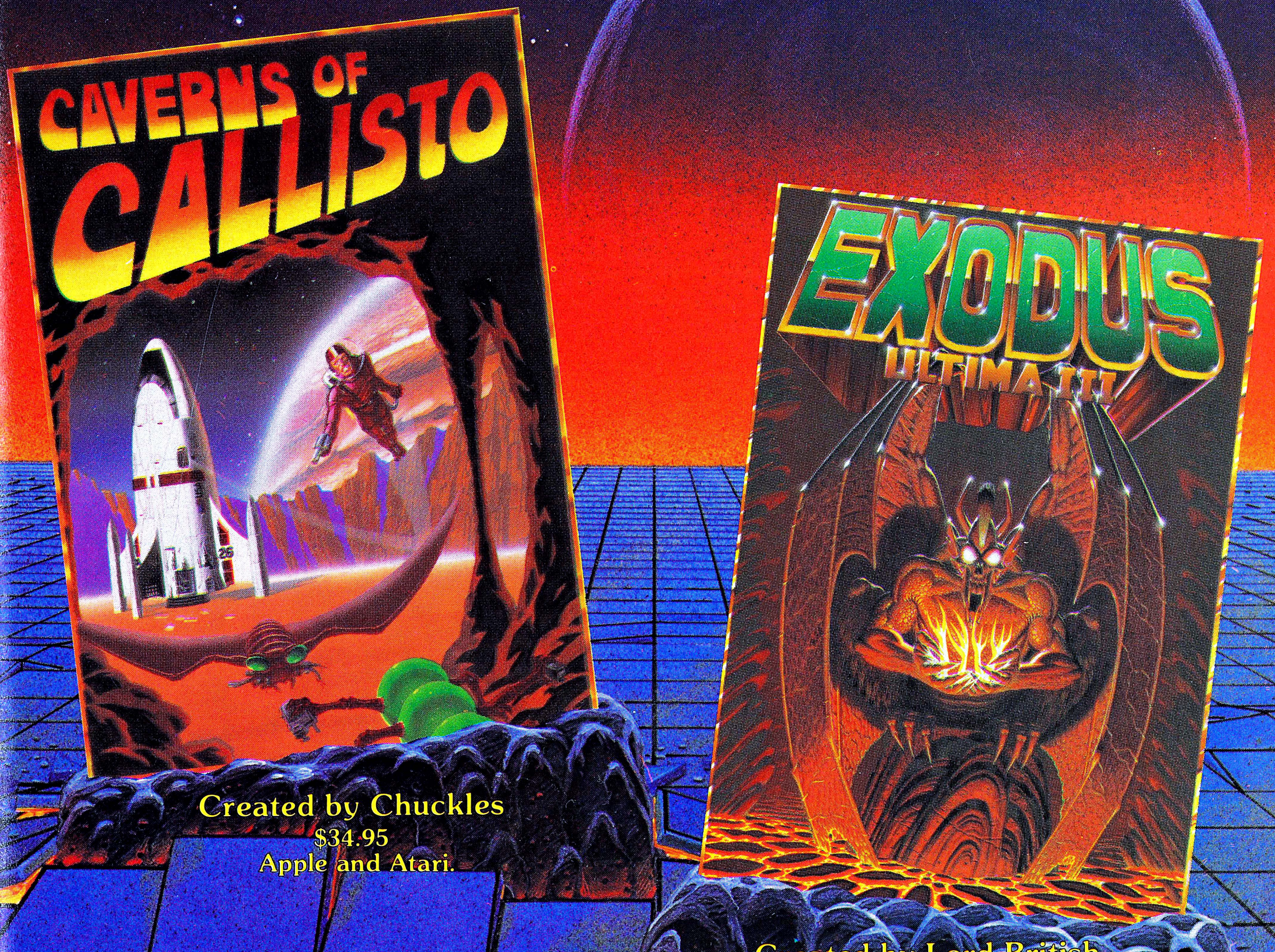

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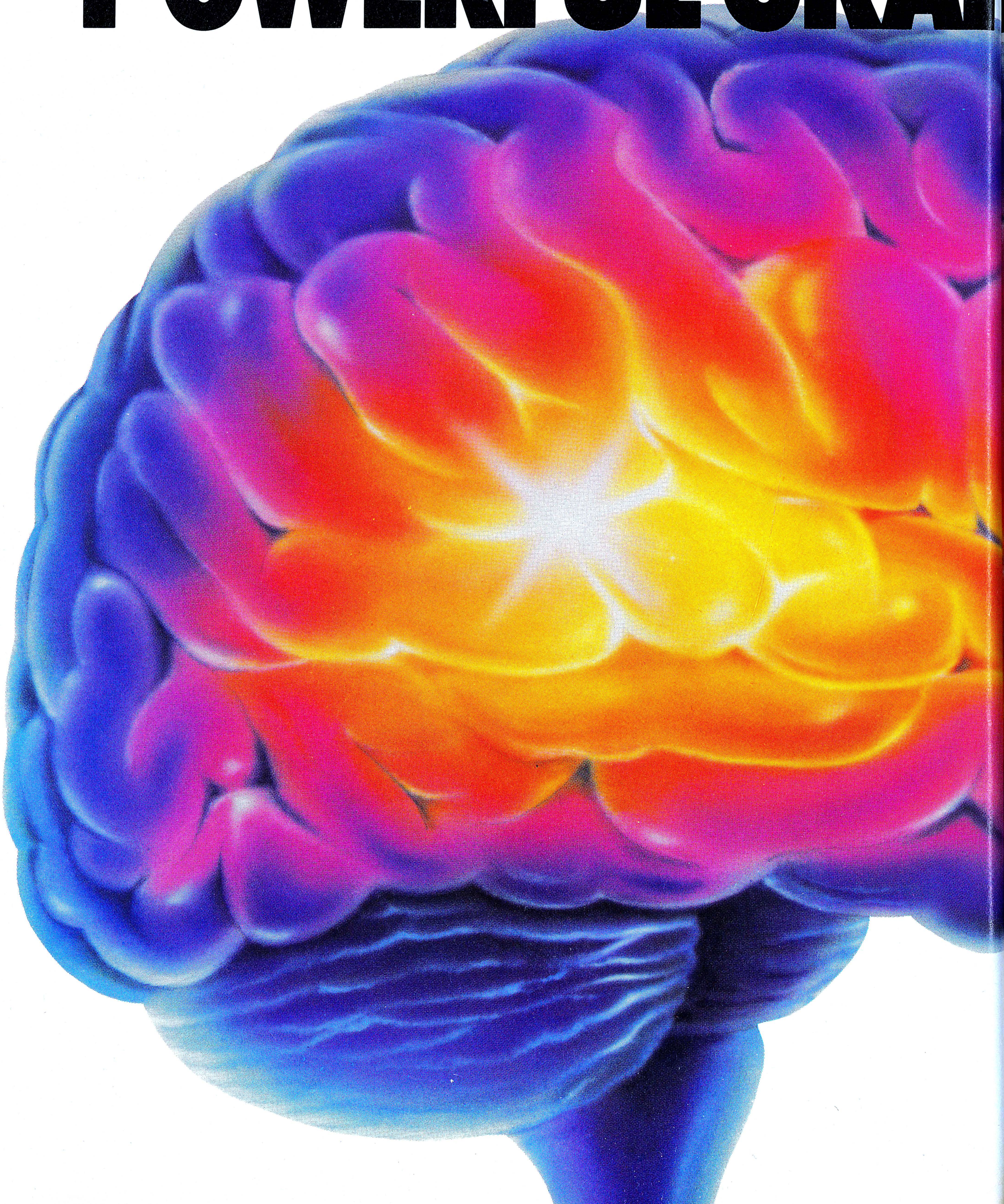
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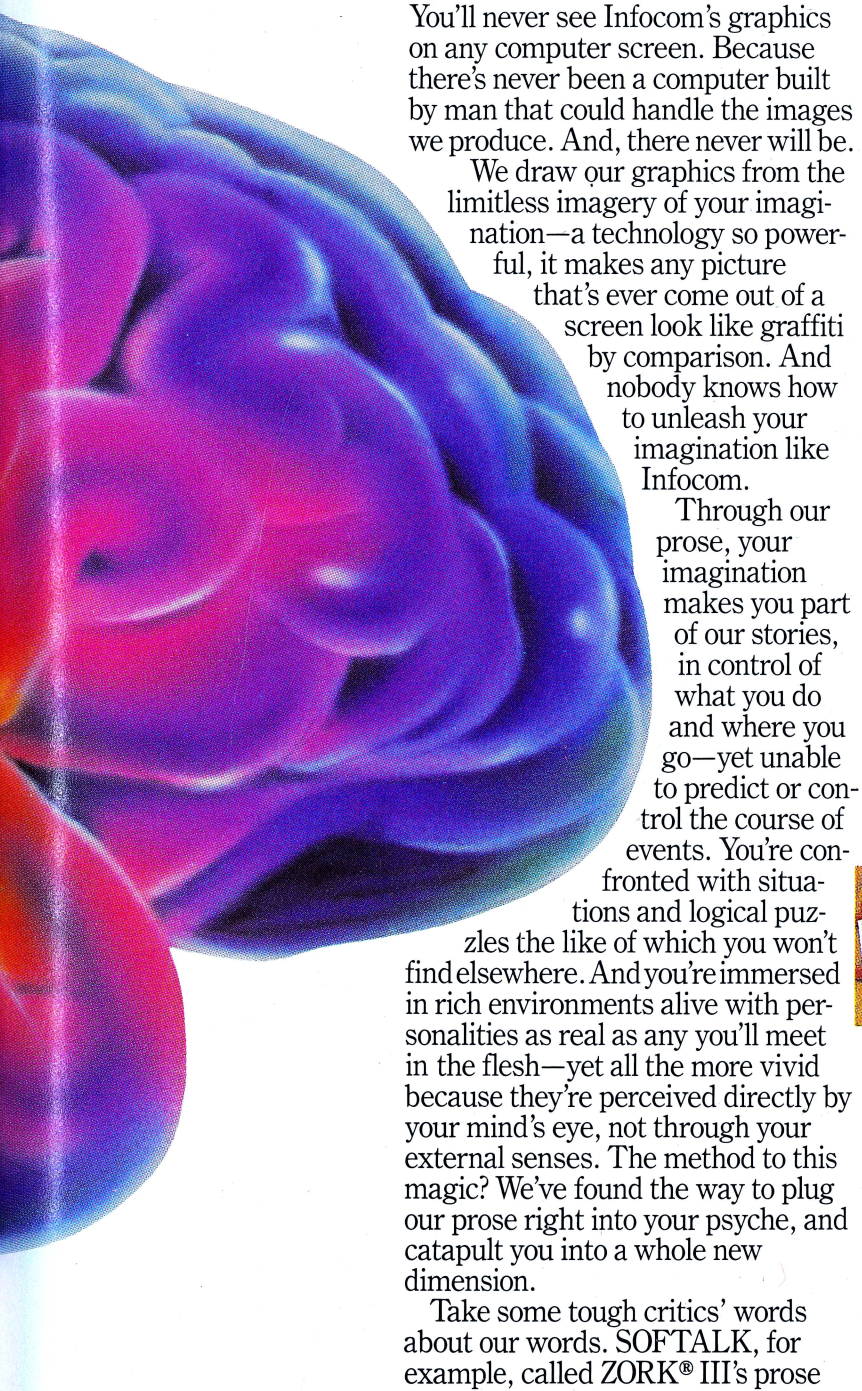

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```
                          ; SHELLSRT
                          ;
                          ; This subroutine will sort any BASIC string array into
                          ;   ascending or descending sequence.
                          ;
                          ; WRITTEN BY HOWARD GLOSSER
                          ;
0000                      CSEG        SEGMENT
0000                      SORT        PROC    FAR
                                      ASSUME CS:CSEG
                          ;
0000  EB 12                           JMP     SHORT SHELLSRT
0002  20                  SEQUENCE    DB      ''                ;ASCENDING OR DESCENDING SEQUENCE
0003  0000                LSTADDR     DW      0                 ;ADDR OF STRING DESCRIPTOR LIST
0005    03 [              SRTWORK     DB      3 DUP(' ')        ;STRING DESCRIPTOR WORK AREA
               20
                  ]

0008  0000                COUNT       DW      0                 ;COUNT OF ENTRIES TO SORT
000A  0000                INDEX       DW      0                 ;INDEX FOR STRING DESCRIPTOR
000C  0000                GAP         DW      0                 ;GAP BETWEEN ITEMS FOR SORT
000E  0000                INTRVL      DW      0                 ;INTRVL WITHIN GAP
0010  0000                LEN1        DW      0                 ;LENGTH FOR COMPARE OF ENTRY 1
0012  0000                LEN2        DW      0                 ;LENGTH FOR COMPARE OF ENTRY 2
                          ;
0014                      SHELLSRT:
0014  55                              PUSH    BP                ;SAVE BP FOR FAR RETURN
0015  8B EC                           MOV     BP,SP             ;MOVE STACK POINTER TO BP
0017  2E: C7 06 0008 R 0000           MOV     COUNT,0           ;ZERO OUT COUNT
001E  8B 76 08                        MOV     SI,[BP]+8         ;POINT SI AT PARM 2
0021  8B 04                           MOV     AX,[SI]           ;MOVE ENTRY COUNT TO AX
0023  3D 0002                         CMP     AX,2              ;ENTRY COUNT >= 2
0026  7C 2A                           JL      ENDIT             ;NO - DON'T DO SORT
0028  2E: A3 0008 R                   MOV     COUNT,AX          ;STORE COUNT
002C  8B 5E 06                        MOV     BX,[BP]+6         ;POINT BX AT PARM 3
002F  2E: 89 1E 0003 R                MOV     LSTADDR,BX        ;STORE ADDRESS OF ARRAY
0034  8B 5E 0A                        MOV     BX,[BP]+10        ;POINT BX AT PARM 1
0037  8B 77 01                        MOV     SI,1[BX]          ;GET ADDRESS OF SEQUENCE FIELD
003A  8B 04                           MOV     AX,[SI]           ;GET VALUE AT ADDRESS
003C  25 00DF                         AND     AX,0DFH           ;MAKE SURE IT'S CAPS
003F  3D 0044                         CMP     AX,'D'            ;DESCENDING SEQUENCE?
0042  75 06                           JNE     ASCEND            ;NO - SET FOR ASCENDING
0044  2E: A2 0002 R                   MOV     SEQUENCE,AL       ;YES -STORE DESCENDING
0048  EB 0C                           JMP     SHORT SORTARRAY   ;GO TO SORT ROUTINE
004A                      ASCEND:
004A  2E: C6 06 0002 R 41             MOV     SEQUENCE,'A'      ;ASCENDING SORT
0050  EB 04                           JMP     SHORT SORTARRAY   ;GO TO SORT ROUTINE
0052                      ENDIT:
0052  5D                              POP     BP                ;RESTORE BP OFF STACK FOR RETURN
0053  CA 0006                         RET     6                 ;FAR RETURN WITH 3 PARMS IN STACK
0056                      SORTARRAY:
0056  2E: A1 0008 R                   MOV     AX,COUNT          ;SET GAP TO
005A  2E: A3 000C R                   MOV     GAP,AX            ;RECORD COUNT
005E                      NEWINT:
005E  2E: D1 2E 000C R                SHR     GA                ;DIVIDE GAP BY 2
0063  74 ED                           JZ      ENDIT             ;IF GAP = 0 THEN WE ARE DONE
0065  2E: A1 000C R                   MOV     AX,GAP            ;MOVE GAP TO AX
0069  2E: A3 000E R                   MOV     INTRVL,AX         ;SET INTRVL = GAP
006D                      NEXT:
006D  2E: A1 000E R                   MOV     AX,INTRVL         ;MOVE INTRVL TO AX
0071  2E: 3B 06 0008 R                CMP     AX,COUNT          ;INTERVAL >= COUNT?
0076  7D E6                           JNL     NEWINT            ;YES - GO TO NEWINT
0078  E8 014A R                       CALL    MOVEWORK          ;MOVE DESCRIPTOR TO WORK AREA
007B  2E: A1 000E R                   MOV     AX,INTRVL         ;MOVE INTRVL TO AX
007F  2E: 2B 06 000C R                SUB     AX,GAP            ;SUBTRACT GAP FROM INTRVL
0084  2E: A3 000A R                   MOV     INDEX,AX          ;SAVE AX TO INDEX
0088                      TESTREC:
0088  E8 00E8 R                       CALL    CMPENTRY          ;COMPARE TWO ENTRIES
008B  9C                              PUSHF                     ;SAVE FLAGS
008C  2E: 80 3E 0002 R 41             CMP     SEQUENCE,'A'      ;ASCENDING SEQUENCE?
0092  75 06                           JNE     DSEQ              ;NO - GO TO DSEQ
0094  9D                              POPF                      ;RESTORE FLAGS
0095  73 24                           JAE     LEAVEIT           ;ENTRIES OK - DON'T SWAP THEM
0097  EB 04 90                        JMP     SETINDX           ;GO AND SWAP ENTRIES
009A                      DSEQ:
009A  9D                              POPF                      ;RESTORE FLAGS
009B  76 1E                           JBE     LEAVEIT           ;ENTRIES OK - DON'T SWAP THEM
009D                      SETINDX:
009D  A1 000A R                       MOV     AX,INDEX          ;MOVE INDEX TO AX
00A1  B9 0003                         MOV     CX,3              ;MOVE DESCRIPTOR LENGTH TO CX
00A4  F7 E1                           MUL     CX                ;MULTIPLY AX BY CX
00A6  2E: 03 06 0003 R                ADD     AX,LSTADDR        ;ADD IN THE ADDRESS BASE
00AB  8B F0                           MOV     SI,AX             ;PUT ENTRY ADDRESS IN SI
00AD  E8 012E R                       CALL    MOVEDSCPT         ;SWAP THE DESCRIPTORS
```

```
00B0    2E: A1 000C R                   MOV     AX,GAP            ;MOVE GAP TO AX
00B4    2E: 29 06 000A R                SUB     INDEX,AX          ;SUBTRACT GAP (AX) FROM INDEX
00B9    7D CD                           JNL     TESTREC           ;CHECK PRIOR ENTRY SET
00BB                    LEAVEIT:
00BB    2E: 8D 36 0005 R                LEA     SI,SRTWORK        ;LOAD ADDRESS OF SRTWORK
00C0    2E: A1 000A R                   MOV     AX,INDEX          ;MOVE INDEX TO AX
00C4    2E: 03 06 000C R                ADD     AX,GAP            ;ADD GAP TO INDEX
00C9    B9 0003                         MOV     CX,3              ;MOVE ENTRY LENGTH TO CX
00CC    F7 E1                           MUL     CX                ;MULTIPLY AX BY CX
00CE    2E: 03 06 0003 R                ADD     AX,LSTADDR        ;ADD IN THE ADDRESS BASE
00D3    8B F8                           MOV     DI,AX             ;PUT ENTRY ADDRESS IN DI
00D5    B9 0003                         MOV     CX,3              ;LOAD CX WITH MOVSB LENGTH
00D8    1E                              PUSH    DS                ;SAVE DS REGISTER
00D9    8C C8                           MOV     AX,CS             ;MOVE CS TO AX
00DB    8E D8                           MOV     DS,AX             ;MOVE AX TO DS
00DD    FC                              CLD                       ;MOVE FORWARD
00DE    F3/ A4                          REP     MOVSB             ;MOVE DESCRIPTOR
00E0    1F                              POP     DS                ;RESTORE DS
00E1    2E: FF 06 000E R                INC     INTRVL            ;INCREMENT INTRVL
00E6    EB 85                           JMP     NEXT              ;GO TO NEXT ONE
00E8                    SORT            ENDP
                        ;
00E8                    CMPENTRY        PROC    NEAR
00E8    2E: A1 000A R                   MOV     AX,INDEX          ;MOVE INDEX TO AX
00EC    B9 0003                         MOV     CX,3              ;MOVE ENTRY LENGTH TO CX
00EF    F7 E1                           MUL     CX                ;MULTIPLY AX BY CX
00F1    2E: 03 06 0003 R                ADD     AX,LSTADDR        ;ADD IN THE ADDRESS BASE
00F6    8B D8                           MOV     BX,AX             ;MOVE AX TO BX
00F8    8B 0F                           MOV     CX,[BX]           ;CX=LENGTH OF ENTRY
00FA    2E: 89 0E 0010 R                MOV     LEN1,CX           ;STORE LENGTH IN LEN1
00FF    8B 47 01                        MOV     AX,1[BX]          ;MOVE THE ADDRESS TO AX
0102    8B F8                           MOV     DI,AX             ;MOVE AX TO DI FOR COMPARE
0104    2E: 8D 1E 0005 R                LEA     BX,SRTWORK        ;LOAD ADDRESS OF SRTWORK TO BX
0109    1E                              PUSH    DS                ;SAVE DS REGISTER
010A    8C C8                           MOV     AX,CS             ;MOVE CS TO AX
010C    8E D8                           MOV     DS,AX             ;MOVE AX TO DS
010E    8B 0F                           MOV     CX,[BX]           ;CX=LENGTH OF ENTRY
0110    2E: 89 0E 0012 R                MOV     LEN2,CX           ;STORE LENGTH IN LEN2
0115    8B 77 01                        MOV     SI,1[BX]          ;POINT SI AT STRING CONTENT
0118    1F                              POP     DS                ;RESTORE DS
0119    2E: 8B 0E 0010 R                MOV     CX,LEN1           ;ENTRY 1 LENGTH IN CX
011E    2E: A1 0012 R                   MOV     AX,LEN2           ;ENTRY 2 LENGTH IN AX
0122    3B C8                           CMP     CX,AX             ;COMPARE TWO LENGTHS
0124    7F 02                           JG      MOVELEN2          ;JUMP IF LEN2 IS SHORTER
0126    EB 02                           JMP     SHORT COMPARE     ;JUMP TO COMPARE
0128                    MOVELEN2:
0128    8B C8                           MOV     CX,AX             ;MOVE LEN2 TO CX
012A                    COMPARE:
012A    FC                              CLD                       ;COMPARE FORWARD
012B    F3/ A6                          REPE    CMPSB             ;DO THE COMPARE
012D    C3                              RET
012E                    CMPENTRY        ENDP
                        ;
012E                    MOVEDSCPT       PROC    NEAR
012E    2E: A1 000A R                   MOV     AX,INDEX          ;MOVE INDEX TO AX
0132    2E: 03 06 000C R                ADD     AX,GAP            ;ADD GAP TO INDEX
0137    B9 0003                         MOV     CX,3              ;MOVE ENTRY LENGTH TO CX
013A    F7 E1                           MUL     CX                ;MULTIPLY AX BY CX
013C    2E: 03 06 0003 R                ADD     AX,LSTADDR        ;ADD IN THE ADDRESS BASE
0141    8B F8                           MOV     DI,AX             ;MOVE ENTRY ADDRESS TO DI
0143    B9 0003                         MOV     CX,3              ;SET CX TO MOVE LENGTH
0146    FC                              CLD                       ;MOVE FORWARD
0147    F3/ A4                          REP     MOVSB             ;MOVE DESCRIPTOR
0149    C3                              RET
014A                    MOVEDSCPT       ENDP
                        ;
014A                    MOVEWORK        PROC    NEAR
014A    2E: A1 000E R                   MOV     AX,INTRVL         ;MOVE INTRVL TO AX
014E    B9 0003                         MOV     CX,3              ;MOVE ENTRY LENGTH TO CX
0151    F7 E1                           MUL     'CX               ;MULTIPLY AX BY CX
0153    2E: 03 06 0003 R                ADD     AX,LSTADDR        ;ADD IN THE ADDR BASE
0158    8B F0                           MOV     SI,AX             ;MOVE ENTRY ADDRESS TO SI
015A    2E: 8D 3E 0005 R                LEA     DI,SRTWORK        ;LOAD ADDRESS OF SRTWORK TO DI
015F    B9 0003                         MOV     CX,3              ;SET CX TO MOVE LENGTH
0162    06                              PUSH    ES                ;SAVE ES REGISTER
0163    8C C8                           MOV     AX,CS             ;MOVE CS TO AX
0165    8E C0                           MOV     ES,AX             ;MOVE AX TO ES
0167    FC                              CLD                       ;MOVE FORWARD
0168    F3/ A4                          REP     MOVSB             ;MOVE DESCRIPTOR
016A    07                              POP     ES                ;RESTORE ES
016B    C3                              RET
016C                    MOVEWORK        ENDP
016C                    CSEG            ENDS
                                        END
```

Figure 6.

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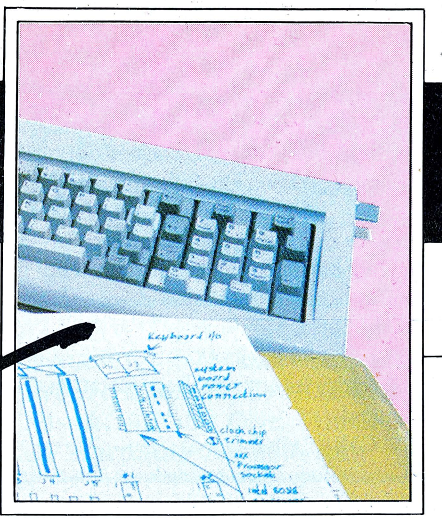

SYSTEM *Notebook*

by Alan Boyd

Backup and *Restore*

This month we'll start taking an in-depth look at how DOS 2.0 fares with IBM's and other vendors' hard disks. By examining the way DOS works with certain devices, such as Winchester drives, you'll see that the operating system can be made to work easily with just about any device.

The operating system does not distinguish between a Winchester and a floppy disk. You'll notice when you boot DOS from the hard disk that the booting procedure appears to be identical to the floppy disk routine; the log-on sequence is the same.

DOS, however, has a few commands that are specific to fixed-disk systems. These commands are designed to address the problem of maintaining adequate backup of the information stored on the fixed disk. Ten megabytes is a lot of storage—the equivalent of more than sixty single-sided floppy disks. The backup task is not trivial.

Some fixed disk manufacturers other than IBM supply proprietary methods of making backups. Some of these methods involve removable media, such as cartridges; some offer tape spooling; and some even make use of the pulse-code-modulation storage features of videotape. For the majority of hard disk users, however, copying to floppy disk is the only affordable method of backing up data.

DOS 2.0 has two commands, *backup* and *restore*, that help you cope with this problem. These commands—if used properly—offer a relatively painless method of maintaining backups for fixed disks.

For the time being we'll assume that you have been through the configuration procedure described in the IBM DOS 2.0 manual and have opted to allocate all the space on the disk as a single DOS partition. The DOS manual clearly describes this procedure, and another discourse on this matter would only be confusing.

Backup. Why do you need *backup* if the *copy* command copies files from one disk to another? Well, here's one reason: What would happen if you had a file on your hard disk that was larger than the capacity of a single floppy? How would you back up such a file with the *copy* command?

The best way to understand this problem is to encounter it for yourself under simulated conditions. First, of course, you need a file that's larger than a single floppy disk can hold. If you don't have such a file, you can use the DOS file-concatenation feature to create one. To do this, you must first create a small text file. A single line of text, entered via the

```
C>COPY CON: TEST
```

command will suffice. Call the file Test. Then create the following batch file:

```
COPY CON: GROW.BAT
COPY TEST + TEST TEST2
DIR TEST*
COPY TEST2 + TEST2 TEST
DIR TEST*
PAUSE Press CTRL-BREAK if the file Test is large enough
GROW
```

When you issue the *grow* command, the file Test will grow very rapidly. After several iterations it will be larger than the size of a single floppy. When this point is reached, stop Grow by pressing control-break. The temporary file named Test2 will also be created in the process. Once you have halted the batch program, you can delete Test2; you won't need it for what you're about to do.

Next, format several blank disks, making doubly sure that you format the disks in drive A and not the fixed disk. (Regrettably, as many have discovered, it *is* possible to erase a hard disk entirely if you misuse the *format* command.) Once you've formatted your blank disks, you'll

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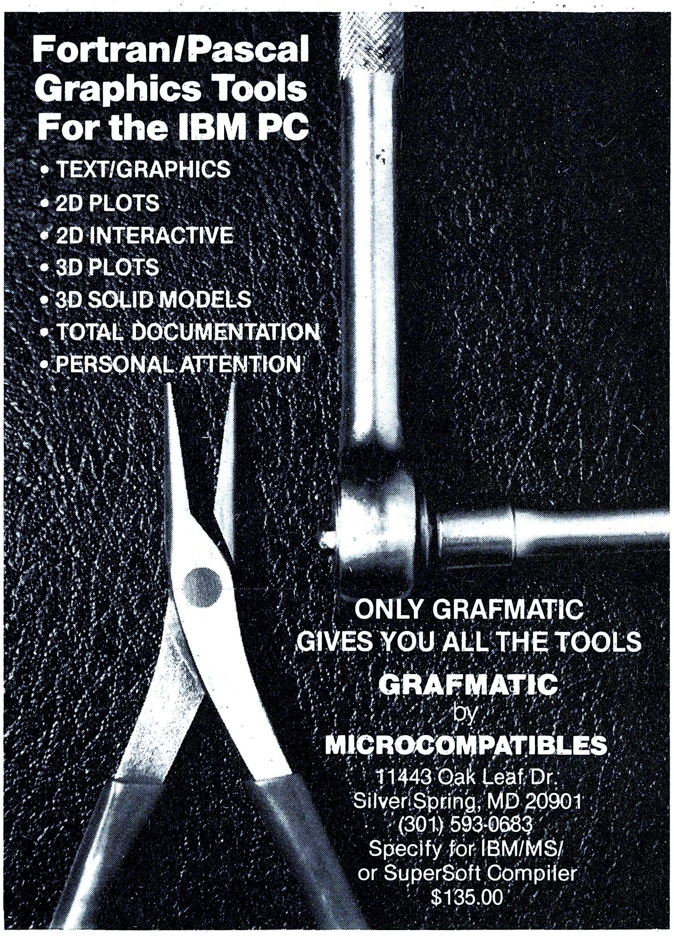
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have all the tools you need to try out both the *copy* command and the *backup* command.

First, try to *copy* Test onto one of the floppies. As soon as the disk is filled you should get an *Insufficient disk space* error message, and the command should terminate, demonstrating that the *copy* command is functionally useless for this job. This is exactly the situation for which the *backup* command is indispensable.

Make sure you have a copy of the file Backup.com on your fixed disk before you start this next exercise. Then enter the following command:

```
C>BACKUP TEST A:
```

The *backup* command will load and run, and it will prompt you to

```
Insert backup diskette 01 in drive A:
Warning! Diskette files will be erased
Strike any key when ready
```

When you press a key the message

```
*** Backing up files to diskette 01 ***
```

will appear, and DOS will go about its business of copying the information in the file Test onto the floppy disk. Once the disk is full, the copying will stop, and *backup* will prompt you again:

```
Insert backup diskette 02 in drive A:
Warning! Diskette files will be erased
Strike any key when ready
```

Note that the diskette number has been incremented. Insert another formatted disk, press a key, and DOS will continue the process. It will request disks until Test has been completely copied.

The *backup* command is the only valid means of backing up files that are larger than a floppy. You will follow a similar procedure if you want to read the file back onto the fixed disk, but only if the original copy on the fixed disk becomes corrupted. Let's hope this situation never happens to you.

Let's take a detailed look at several other useful options available with the *backup* command. These options take the form of switches on the command line. The full syntax of the *backup* command is

```
BACKUP filespec d:/S/M/A/D
```

with each of the switches optional. *Filespec* defines the file or files that you want backed up; it can include a full pathname and drive designator. The *d:* specifies the disk drive containing the floppy disk that's to hold the backed-up image.

The /S switch tells DOS that you want to include all the files in any subdirectory in your backup operation. For example, if you issue the command

```
C>BACKUP C:\ A:/S
```

you are telling DOS to back up the entire fixed disk. The C:\ tells *backup* that the hard disk's root directory is the data source. The A: tells it that the destination of the data is a disk, or series of disks, in drive A. The /S switch tells *backup* to include *any* files found in *any* subdirectories—which means that all files on the hard disk will be backed up.

If you didn't include the /S switch in the command, *backup* would copy only the files in the root directory, bypassing any subdirectories.

The second switch, /M, tells *backup* that you want to back up only those files that have been modified since the last backup. For this option to work, obviously you need to have done at least one backup already.

You can try out this version of *backup* on the file Test. Enter the command

```
BACKUP TEST A:/M
```

and see what happens. When you insert the first backup disk, DOS checks to see if the file has been modified since you last backed up. Since you haven't changed Test, DOS issues the message

```
Warning! No files were found to back up
```

and terminates the command. If you want, you can make a slight modification to the Test file by concatenating something to it and trying the /M switch again. This time the backup should work.

When it finds the /M switch, *backup* checks the directory on the fixed disk and compares it to a copy of the directory on the backup disk. If it finds that a file specified on the command line has been written to since the last backup, it copies it. If the file in question hasn't been written to, *backup* bypasses it. If you are backing up more than one file, *backup* simply passes over the files that haven't been modified. The /M switch thus offers incremental backup capability, speeding up the process for the benefit of those who back up their files on a regular basis.

Including the third switch, /A, on the command line tells *backup* to add your new backup files to a disk that already contains other backed-up files. This switch ensures that *backup* will not erase any files on the target disk but simply use whatever space is left over. This switch was provided as a way of helping you economize on floppy disk space.

The final switch, /D, tells *backup* that it should back up only those files that have been written to on or after a specified date. For example, the command

```
C>BACKUP C:\ A:/D:01-13-84
```

tells *backup* to copy only those files created or modified on or after January 13, 1984.

By combining the *backup* command's switches you can effectively back up only those files you want to back up. Use this command liberally. Floppy disks may not be cheap, but the consequences of damage to a fixed disk could be disastrous.

Files stored on a disk by the *backup* command are not stored in the regular file format and are therefore not usable from DOS as commands, text files, or programs. They are simply backed-up images of the original files, and before they can be used they must be replaced on the fixed disk (via the *restore* command). If you were to look at a directory listing of a disk used to hold backed-up files, you would see that

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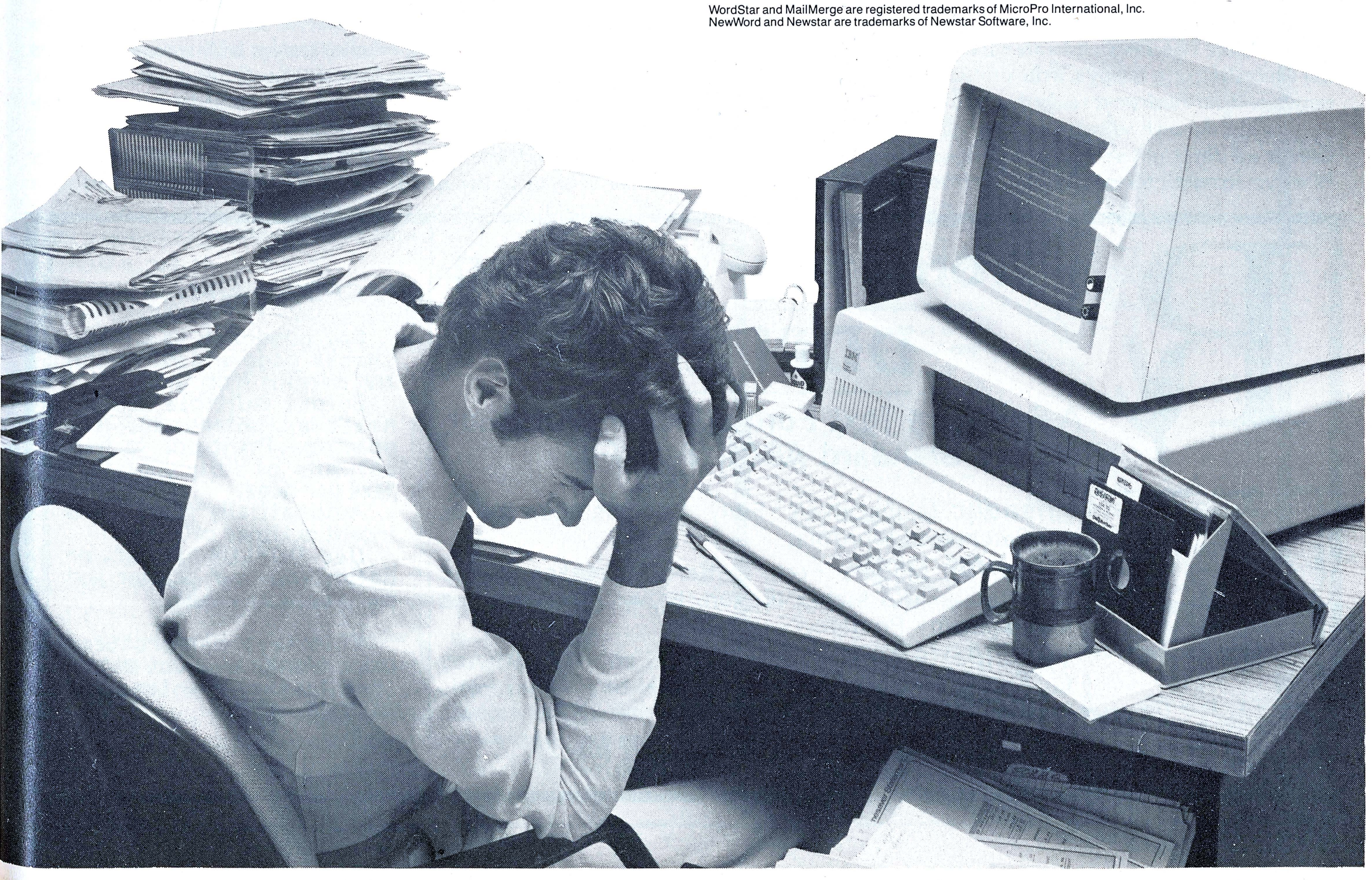

they contain a file called Backupid.@@@. This file contains the information about the backed-up files; it must be present on the backup disk if you are to restore the files to the fixed disk.

Restore. The *restore* command is the functional and logical complement to the *backup* command. It is used to reconstruct original files from their image stored on backup disks. *Restore* should be used only in those situations where the original data on the fixed disk is rendered unusable. It is not recommended that you use the *backup/restore* combination as a cheap way of increasing the capacity of your PC. There is no substitute for a fixed disk when large amounts of data are involved. The *backup/restore* system is simply an insurance policy against the accidental loss of valuable data.

To use the *restore* command, you should enter commands that are the logical opposites of the *backup* commands. The full syntax of the command is

```
C>RESTORE d: filespec/S/P
```

The *d:* represents the floppy disk drive from which the previously backed-up data will be read. *Filespec* tells *restore* which file or files to reconstruct. It should include the drive designation for the fixed disk onto which you want to restore the files and the appropriate pathname where one is required.

The *restore* command's two switches are also highly functional. The first of these, /S, tells *restore* to reconstruct any files in any subdirectory of the specified directory. If this switch is not appended to the command, *restore* operates only on those files that are in the specified directory. The command

```
C>RESTORE A: C:\/S
```

tells *restore* to bring back all the files that are on the floppy disks. This is somewhat similar to the *backup* command's /S switch.

The second switch, /P, tells *restore* to prompt before it restores any files that have been modified since they were backed up. *Restore* with /P also prompts before restoring any files that are marked in the directory as read-only. This procedure prevents the accidental replacement of good data by earlier versions.

This points up one of the limitations of fixed disks as compared to floppies. Since Winchester disks are not removable, they have no physical equivalent of a floppy's write-protect notch. Consequently, you can abuse them much more easily than you can a floppy disk. Although it's possible, through software, to determine that a file is read-only, there is no direct physical protection against writing to such a file. When you consider the mass of data that can be lost from a fixed disk, more ammunition is added to the argument for a routine backup procedure.

You may want to try the *restore* command on the file Test that we were working with earlier. To do this, simply erase the file from your hard disk to simulate its accidental removal, then enter the command

```
C>RESTORE A: C: TEST
```

You'll then be invited to

```
Insert backup diskette 01 in drive A:
Strike any key when ready
```

and when you do so, the *restore* command will go to work. First it will show you the date the file was backed up; this lets you see how old the backup is. It will then copy all the data from floppy to fixed disk. When it has finished restoring the information on the first floppy, it will prompt you to insert the subsequent disk—and will continue in this manner until all the information has been restored.

If, for some reason, you insert the wrong disk or if the disks are out of sequence, you will be warned by the following error message:

```
Warning! Diskette is out of sequence
Replace the diskette or continue
Strike any key when ready
```

If you don't replace the disk with the correct one but simply press a key, you will be given the message

```
***Restoring files from diskette XX ***
```

where XX is the diskette number in the sequence. Then, *restore* will stop, print the error message

```
Backup file sequence error
```

and return you to the command line. This procedure prevents you from compounding errors by getting the backup disk sequence out of order.

The *backup* and *restore* commands support the *errorlevel* condition that can be tested through the *if* statement in batch files. This means that you can prepare batch files that force an operator to back up new data before leaving the system.

The Config.sys File. Now that we've taken a look at all the commands applying to fixed-disk systems—be these systems supplied by IBM or not—it is time to take a look at another DOS feature that makes it possible to attach any manufacturer's fixed disk and have it work with the operating system as though it were a standard piece of hardware.

Installable Device Drivers. DOS 2.0 corrects problems in the way earlier versions of the operating system handled "foreign" devices (a

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foreign device is a peripheral that isn't supplied by IBM or that was added as an afterthought by IBM; third-party fixed disks are good examples of such devices).

To use foreign devices with earlier versions of DOS, you had to patch the operating system by modifying the BIOS interface to DOS. This did not in itself create any problems for the user; the problems arose when more than one foreign device was implemented.

If more than one patch was made to DOS, there was always the possibility that a conflict could arise when two devices tried to patch the same part of the operating system. The results could be catastrophic. If one of the devices was a fixed disk, then all the data could be lost.

DOS 2.0 addresses the problem of potential incompatibility between devices by defining a standard method of interfacing any foreign device with the PC. The method is to use a program, known as a *device driver,* that manages all communication between the PC and the device in a standard fashion. Another facility of DOS allows you to add device drivers to the system in an ad hoc manner. The installation process is simple.

When manufacturers ship a foreign piece of hardware, they should include a device driver on disk. It's up to you, then, to add the device driver to your system. Installation involves typing a sequence of characters and perhaps copying a disk file or two.

Whenever DOS is booted, it examines the master disk to see whether any device drivers are to be installed. If it finds one or more drivers, it loads them into memory and activates them, thereby attaching to the PC those peripherals that the device drivers service. It's obvious, then, that DOS has to have some way of knowing whether there are device drivers to be installed.

The installation process requires you to create a special file under the reserved name Config.sys; this file is used to pass the names of any installable device drivers to DOS so that the system can load them at boot time. Config.sys is a simple ASCII file that can be prepared with any ASCII text editor or word processor. The file's format is just a series of lines that tell DOS which drivers to load. You can also use Config.sys to modify various other system defaults.

Suppose, for example, you want to install a mouse on your PC. The mouse's manufacturer should provide a disk containing a driver for the mouse. If no device driver is present, then it's doubtful that commercial software will work with the mouse (although it should be possible to write special software to allow the mouse to work).

Let's assume you have the device driver stored on the disk under the name Mouse.sys. To ensure that the device driver is installed each time the PC is started, the statement

```
DEVICE = MOUSE.SYS
```

needs to be added to the Config.sys file. If you don't have such a file, then you'll need to create one. If you also use a clock/calendar card and a RAM disk, then your Config.sys file might look like this:

```
DEVICE = MOUSE.SYS
DEVICE = CLOCK.SYS
DEVICE = RAMDRIVE.SYS
```

The three files

```
MOUSE.SYS
CLOCK.SYS
RAMDRIVE.SYS
```

must also be present on your boot disk.

If you're installing a foreign hard disk functionally identical to IBM's, then you won't need to use a device driver. If the hard disk is not functionally equivalent, then a device driver should be installed. If you plan to use other devices, avoid fixed disks that don't use device drivers but instead modify DOS; modifying DOS is extremely dangerous.

Config.sys is something of a super batch file that's loaded and interpreted whenever the system is booted. The file can also be used to set various other configuration parameters. There are five special com-

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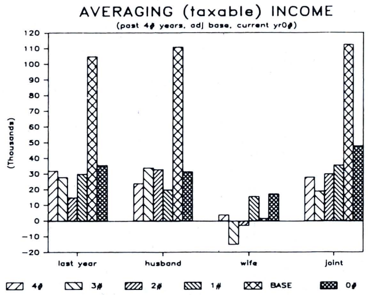

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Schedule B
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Schedule C
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Schedule D
Capital Gains (Loss)
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Schedule G
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Form 2119
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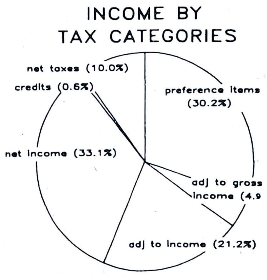

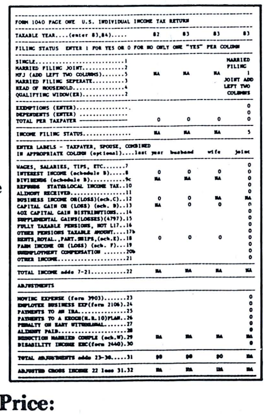

```
---------------------------------------------------------------------------
FORM 1040 PAGE ONE  U.S. INDIVIDUAL INCOME TAX RETURN
---------------------------------------------------------------------------
TAXABLE YEAR....(enter 83,84).....        82        83        83        83
---------------------------------------------------------------------------
FILING STATUS   ENTER 1 FOR YES OR 0 FOR NO ONLY ONE "YES" PER COLUMN
---------------------------------------------------------------------------
SINGLE............................1                                MARRIED
MARRIED FILING JOINT..............2                                 FILING
MFJ (ADD LEFT TWO COLUMNS)........5       NA        NA        NA         1
MARRIED FILING SEPERATE...........3                              JOINT ADD
HEAD OF HOUSEHOLD.................4                               LEFT TWO
QUALIFYING WIDOW(ER)..............2                                COLUMNS
---------------------------------------------------------------------------
EXEMPTIONS (ENTER)................                                       0
DEPENDENTS (ENTER) ...............                                       0
TOTAL PER TAXPAYER ---------------         0         0         0         0
---------------------------------------------------------------------------
INCOME FILING STATUS..............        NA        NA        NA         5
---------------------------------------------------------------------------
ENTER LABELS - TAXPAYER, SPOUSE, COMBINED
IN APPROPRIATE COLUMN (optional)....last year  husband      wife     joint
---------------------------------------------------------------------------
WAGES, SALARIES, TIPS, ETC.......7                                       0
INTEREST INCOME (schedule B).....8         0         0         0         0
DIVIDENDS (schedule B)..........9c        NA        NA        NA         0
REFUNDS  STATE&LOCAL INCOME TAX..10                                      0
ALIMONY RECEIVED.................11                                      0
BUSINESS INCOME OR(LOSS)(sch.C)..12        0         0        NA        NA
CAPITAL GAIN OR (LOSS) (sch. D)..13       NA         0         0         0
40% CAPITAL GAIN DISTRIBUTIONS...14                                      0
SUPPLEMENTAL GAINS(LOSSES)(4797).15                                      0
FULLY TAXABLE PENSIONS, NOT L17..16                                      0
OTHER PENSIONS TAXABLE AMOUNT....17b                                     0
RENTS,ROYAL.,PART.SHIPS,(sch.E)..18        0         0         0         0
FARM INCOME OR (LOSS) (sch. F)...19                                      0
UNEMPLOYMENT COMPENSATION .......20b                                     0
OTHER INCOME.....................21                                      0
---------------------------------------------------------------------------
TOTAL INCOME adds 7-21...........22       NA        NA        NA        NA
---------------------------------------------------------------------------
ADJUSTMENTS
---------------------------------------------------------------------------
MOVING EXPENSE (form 3903).......23                                      0
EMPLOYEE BUSINESS EXP(form 2106).24                                      0
PAYMENTS TO AN IRA...............25                                      0
PAYMENTS TO A KEOGH(H.R.10)PLAN..26                                      0
PENALTY ON EARLY WITHDRAWAL......27                                      0
ALIMONY PAID.....................28                                      0
DEDUCTION MARRIED COUPLE (sch.W).29       NA        NA        NA        NA
DISABILITY INCOME EXC(form 2440).30                                      0
---------------------------------------------------------------------------
TOTAL ADJUSTMENTS adds 23-30.....31       $0        $0        $0        NA
---------------------------------------------------------------------------
ADJUSTED GROSS INCOME 22 less 31.32       NA        NA        NA        NA
---------------------------------------------------------------------------
```

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mands that can be included in the configuration file to change some of the PC's default settings. The first of these is the *device* = command we looked at a moment ago. Let's now look at the other four.

The *Break* Configuration Command. As we saw when we looked at the regular DOS *break* command (December 1983), the level at which DOS checks to see if you've typed control-break can be changed from its normal state to an extended one (a state in which checking occurs more frequently). You can do this through the regular *break on/off* command; you can also do it through the *break* configuration command.

If you want the extended control-break check always to be on, you can include the command

```
BREAK ON
```

in the configuration file. Later, if you want, you can turn the control-break check off from the command line or from a batch file via the regular DOS *break* command.

The *Buffers* Configuration Command. At boot time, under normal circumstances, DOS creates two areas in memory to use as buffers for passing data to and from disk files. You can change this default number of buffers by including a *buffers* command in your configuration file. The command can specify from one to ninety-nine buffers.

The more buffers available to DOS, the faster the system is likely to operate when an application program makes system calls. This is so because, with more buffers available, the application program will probably need to go to disk less often. On the other hand, each buffer consumes 528 bytes of memory. However, if you're using a PC with lots of memory, you may be able to speed up your applications by allocating more buffers.

The way to allocate buffers is to include the command

```
BUFFERS = XX
```

in the configuration file. XX can be any number from 1 to 99. If you're tempted to change the number of available buffers, note that DOS operates well with only two buffers in the default condition. Making large numbers of buffers available may or may not increase the read/write speed of the PC significantly; it depends on the application program.

The *Files* Configuration Command. DOS 2.0's directory system provides a convenient and efficient method for application programmers to create and maintain files. It's technically a vast improvement over version 1. However, under the default settings of the operating system, only eight files may be open at any time. This number is based on practical but somewhat arbitrary conclusions about the nature of application programs.

Many applications work with more than one file at a time. Generally, if you try to open too many files, a DOS error condition results. For most applications, a limit of eight files open at once is no hardship. However, DOS makes it easy for your program to have more than eight open files, if necessary. To change the open-file limit, just place a *files* command in your Config.sys file. This command takes the form

```
FILE = XX
```

where XX is a number from 1 to 99. The overhead associated with each file is only thirty-nine bytes. However, there's no advantage in having a large number of files available for concurrent use unless you've been having problems. If you're using an application program that doesn't run on a standard DOS system, or if you wish to create an operating environment that allows more than eight files to be open at a time, then make use of the *files* command.

The *Shell* Configuration Command. The last of the configuration commands is *shell* (not to be confused with the Basic *shell* command). *Shell* lets you change the name of the default command processor used by DOS. Normally the command processor is stored in the file named Command.com. It is possible, however, to replace this command processor.

Command.com is an integral part of DOS and cannot be replaced by just any old program. The command processor must perform some very special functions. The way to substitute another command processor for Command.com is by using the *shell* configuration command.

You can install your own command processor at boot time by including the statement

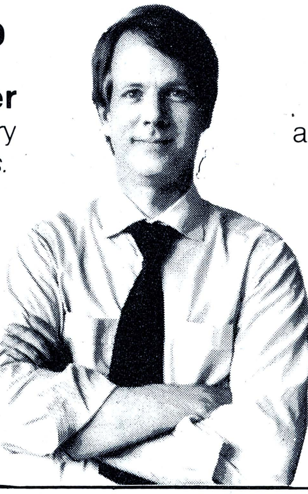
```
SHELL = filename
```

where *filename* specifies the file containing the new command processor.

If you do replace the command processor, then none of the facilities of DOS—internal commands, batch processing, and the like—will be available unless they are duplicated in the new command processor.

The creation of a new command processor is an immensely complex job, one that should be attempted only by a programmer familiar with the internal workings of DOS.

There are few rules about what can and cannot be done with DOS for a particular hardware configuration. If you use your PC to run off-the-shelf programs, then you'll probably never need to change the default configuration. But if you do need to change the defaults to accommodate specialized applications, you can. ▲



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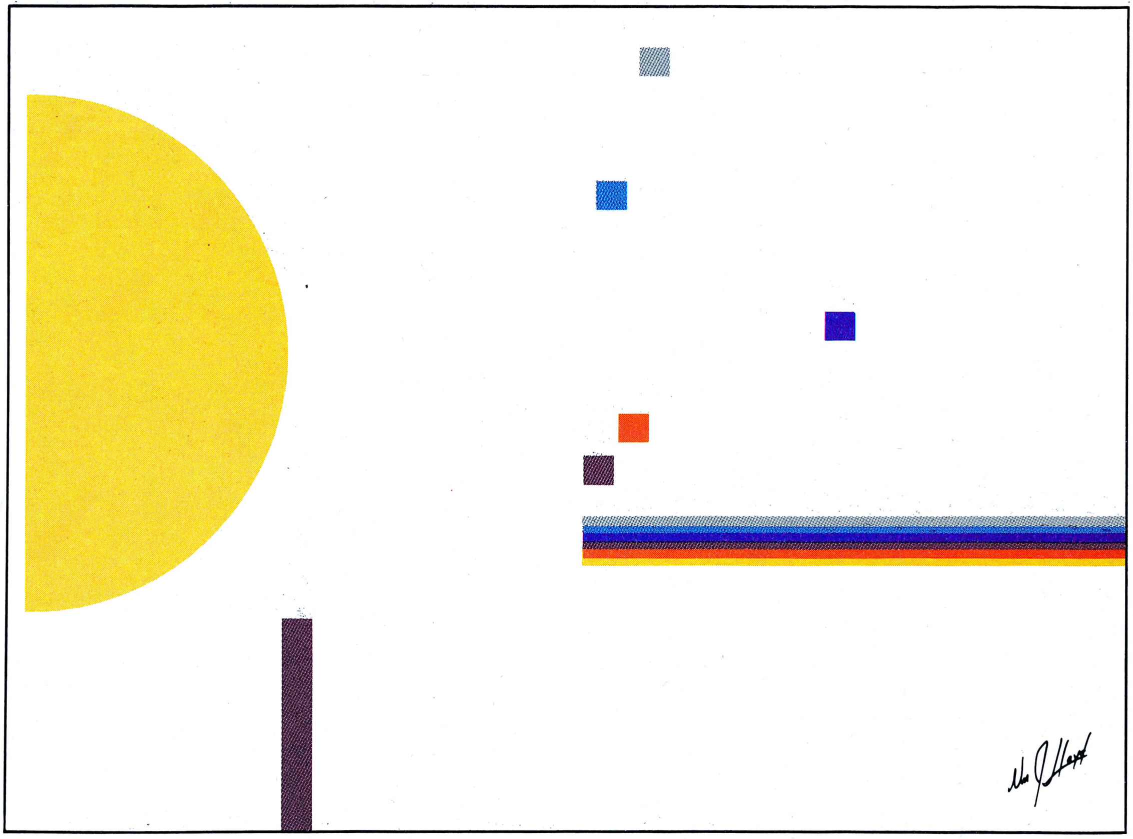

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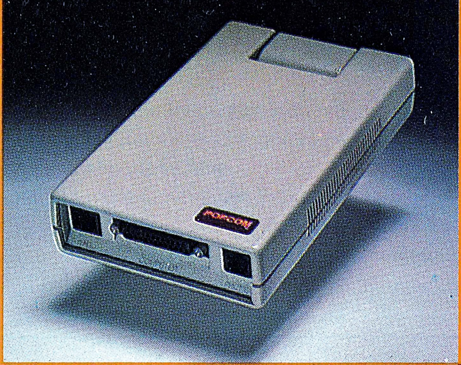

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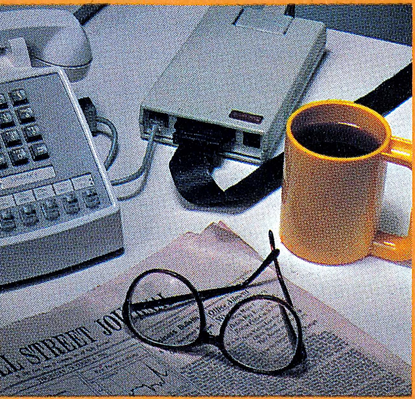

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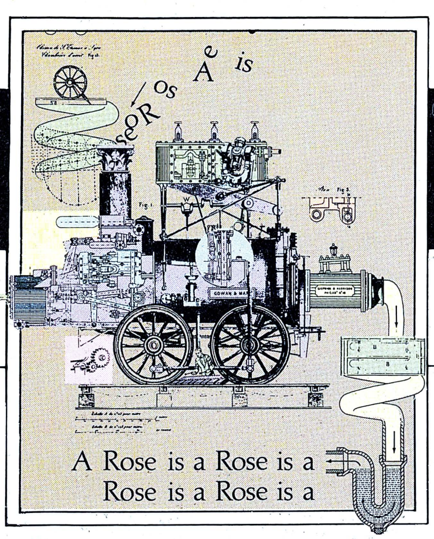


A Rose is a Rose is a
Rose is a Rose is a

by Terry Tinsley Datz and F. Lloyd Datz

XyWrite II

Ask the people at XyQuest what's outstanding about their word processor, *XyWrite II*, and they'll sum it up with one word—speed. Think of *XyWrite II* as a ten-speed racing bicycle: When you're in a hurry, you can put your head down and fly. But rookies beware—you ride this streamlined model at your own risk and without benefit of training wheels such as menus, prompts, and the like.

There's a reason behind XyQuest's obsession with speed. Its founders, Dave Erickson and John Hill, were involved in development of the Atex system, a text-editing phototypesetting system widely used by newspapers and magazines. A reporter racing against a deadline doesn't have time to plod through a series of menus; neither does the editor who does the rewrite. And, to Erickson and Hill's way of thinking, neither do PC users whose primary concern is productivity.

But *XyWrite II* has more going for it than a streamlined framework. Its price, for one thing, is striking ($195). And it has several features you won't find on many of the PC's word processors: It does split-screen editing; generates footnotes, indexes, and tables of contents; gives you access to DOS from within the editor; and allows you to set up macros.

Overall Design. In the interest of saving you keystrokes (keystrokes = time), *XyWrite* disdains menus and mode changes and relies instead on individual commands—nearly one hundred fifty of them. It assigns frequently used operations, including most of the editing commands, to the function keys in combination with control, alt, or shift. A few of these combinations, though, put your manual dexterity to the test (try alt-F1 sometime).

Those commands that don't involve the function keys use mnemonics, which you type on a command line at the top of the screen. The command-line concept is one that takes some getting used to. Before you can enter a command, you always have to hit F5 to position the cursor in the command line; hitting return after the command takes you back to your text. Until you adapt to this routine, you'll find yourself typing commands without effect directly into your text.

Text Entry and Editing. The editing screen is clear except for three lines at the top. The first line is the previously mentioned command line. *XyWrite*'s second line displays its messages and thoughtfully lets you know when you've engaged caps lock, num lock, or scroll lock. The third line contains a shorthand reminder of what each of the function keys does. If you press control-F9, all twenty-four control-alt-shift combinations of these keys scroll horizontally across the screen. Noticeably missing from the top of the screen are cursor-position indicators (column, line, and page). This omission, coupled with the fact that *XyWrite* doesn't routinely show page breaks, keeps you in the dark about the cursor's exact location in relation to the rest of your text.

XyWrite gives you good cursor control, but moving the cursor takes both hands away from the home keys. The arrow, home, and end keys, used in various combinations with the control and alt keys (on the other side of the keyboard), move the cursor forward and backward by character, word, and line; to the left and right margins; and to the top and bottom of the screen or document. As you'd expect, the page-up and page-down keys scroll by the screenful; when combined with the control key they scroll a line at a time. You can scroll the cursor horizontally up to 255 columns. *XyWrite* keeps you uninformed about page numbers, so it goes without saying that you can't jump to a specific page number.

The editor defaults to insert mode. While you are in insert, text pushes ahead no matter how fast you type—unless you're working with lines longer than eighty columns, in which case the screen lags behind a bit. The insert key toggles you into overstrike mode and, as a thoughtful reminder, changes the cursor from a rectangle to an underscore.

For those of us who are victims of the PC's misplaced left shift key, *XyWrite* has an automatic uppercase mode. In this mode the program automatically capitalizes the next character you type after any sentence-ending punctuation mark (period, question mark, or exclamation mark). Except for words that you want capitalized in midsentence, you can ignore the shift key and let *XyWrite* do the capitalizing. This system breaks down, of course, if you use a lot of abbreviations that end with periods.

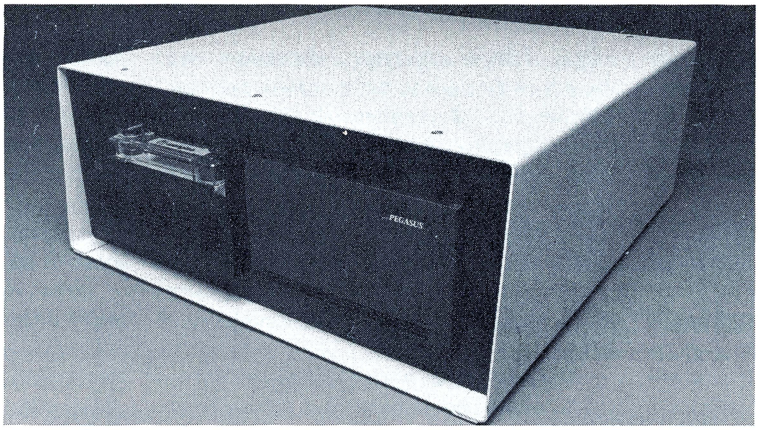
There's no shortage of deleting options. The delete and backspace keys work, as you'd expect, on the character under and to the left of the cursor respectively. Alt-delete erases the word at the cursor position, control-delete erases to the end of the line, and alt-F5 (no logic here) wipes out the entire line. If you accidentally erase a word or line, you can retrieve it by hitting alt-F3.

XyWrite gives you two ways to define blocks of text. One way is to position the cursor at one end of the block, press F1, then move to the other end using any of the cursor commands. The text intensifies as the cursor passes over it. If you make a mistake or change your mind, just move the cursor in the other direction.

Your other block-defining option is to mark words, sentences, or paragraphs in one jump using the F4 key combined with control, alt, or shift. This method won't allow you to back up; if you overshoot the end of the block, you have to hit F3 to undefine it and then start over again. Nor can you combine the two methods by using the F1 key to fine-tune what you mark with the F4 key.

Once you've marked your text, there's almost no limit to what *XyWrite* can do with it. For starters, there are the usual copy, move, and delete options. *XyWrite* stores deleted blocks in a buffer from which you can recall them in the event you have second thoughts. Other options include storing your block in a separate file, assigning it to an alt-key macro (more about that later), copying it between windows, changing its case, or having it underlined, boldfaced, or displayed in inverse video.

You can also define columns as blocks and then move them (or, for that matter, do any of



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Dealer Inquiries Invited **800-323-6836** In Illinois (312) 884-7272 the other operations listed earlier) without disturbing their format. To mark a column, you position the cursor at one corner, strike alt-F1, move to the opposite corner, and repeat alt-F1. Then you can manipulate the column just as you would any other block of text, except that in this case *XyWrite* behaves unpredictably, sometimes jumping ahead by several screens after it moves the column.

XyWrite's math function comes in handy when you're working with columns of numbers. You can add and subtract down or across columns by positioning the cursor over each number and pressing alt along with either the plus or minus key. When you're ready for the total, position the cursor where you want it inserted and hit alt and =. You can also do calculations in the command line should you get the urge to crunch numbers when your pocket calculator's nowhere to be found.

XyWrite will search both forward and backward from the cursor position, ignoring capitalization or not, as you wish. One thing you can't do is specify that only whole words be found as opposed to strings that occur inside of other words. If you want only whole words, you have to type in the word you're searching for with spaces on each side. This means, of course, that you miss any occurrences of words adjacent to punctuation marks (words at the ends of sentences, for example). On the plus side, your search string can contain wildcards.

XyWrite also does global replacements, either automatically or with confirmation before each change (the latter being a safer choice in most cases). If you use the automatic method and change your mind halfway through, you can interrupt the process by hitting control-break.

The split-screen feature allows you to work on two files simultaneously, a handy option when you need to transfer information between two files or when you're rewriting a first draft. What's more, *XyWrite* is extremely flexible about how you do your splitting. You can divide the screen from top to bottom or from side to side at any column or line. A third option is to switch back and forth between two full screens.

To invoke the split-screen feature, you press alt-F10 and make choices from a menu (yes, *XyWrite* does have a couple of menus) to indicate the manner in which you want the screen to split. For example, to split the screen horizontally at line 20, you select H and then type *20*. Alt-F10 switches the cursor back and forth between the two windows, only one of which can be active at a time.

Formatting and Printing. You control your document's format by typing individual commands—most of them mnemonics such as LS for line spacing and JU for justification—into *XyWrite's* command line. All formatting commands stay with your document, so you don't have to retype them on subsequent edits.

What you see on-screen as you edit depends on which of two formatting options you choose. If you choose *expanded input mode*, your formatting commands appear scattered throughout the text; none of them has any effect on-screen. The command to set a left margin to 10, for example, would appear as `<<LM 10>>` in your text wherever you changed the margins; the margins themselves would appear unchanged on-screen.

In *XyWrite's* default mode, appropriately called *formatted input mode*, you can see the immediate effect of most formatting commands, with some noteworthy exceptions: line spacing, page breaks, full justification, headers, footers, and footnotes. The commands themselves appear in your text as bright-intensity triangles; when you position the cursor on top of a triangle, the command represented by that triangle appears in the status line. As you edit, you can switch back and forth between this mode and expanded input mode to get a look at the exact commands you've inserted. In both modes, *XyWrite* automatically tightens up your text as you make insertions and deletions, so you don't need to reform each paragraph manually.

If you want to see your document exactly as it will print, complete with page breaks, footnotes, and full justification, a page-review command prints your file to the screen. When you're working with long files and limited memory, you have to save your file to disk first; otherwise you can do a review directly from memory, taking advantage of *XyWrite's* split-screen capability. In either case, this mode is strictly for review, not for editing.

For example, if you discover a page break that needs adjusting, you have to switch back into formatted input mode to force a page break. Since changing one page break is likely to affect all that follow, you then have to do another page review to make sure other breaks haven't been adversely affected. This is a major weakness in a program that prides itself on efficiency.

For blocks of text that you don't want split between two pages, such as tables or lists, you can embed a *no break* command. A handy sidekick of the no break command is the *page length* command, which lets you specify, in addition to the normal number of lines you want on each page, the maximum number you'll allow under extenuating circumstances. If you define your page length as fifty-five lines, for instance, you can also specify a maximum

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length of, say, sixty lines. Then, whenever *XyWrite* encounters a no break command, it has an extra five lines within which to fit the unbreakable block. This prevents you from ending up with a short page when you've got a table or list that's just a couple of lines too long.

XyWrite defaults to ragged right margins, but you can also have your text centered between the left and right margins, printed flush against the right margin (with the left margin ragged) or fully justified. A major disadvantage with *XyWrite*'s handling of full justification is that it resorts to inserting full spaces, as opposed to microspaces, to even out the margins; the result is text with a "spaced-out" appearance. Nor do you get any assistance with hyphenation. You can, however, insert discretionary hyphens by inserting a tilde character in words you want divided. Such a hyphen prints only if the word falls at the end of a line.

You set tab stops by typing *TS* followed by the column numbers (relative to the left margin) where you want tabs. If you change your left margin, your tab stops change relative to the new margin setting. *XyWrite* handles only regular tabs; it won't automatically align your numbers by decimal point.

XyWrite is lenient when it comes to headers and footers, allowing you to position and format them any way you want. For example, you can have them printed book style, alternating them flush left and flush right. They can be many lines long—up to a full page, if for some reason you want to do away with the main text altogether.

Automatic footnoting, a rarity among word processors, is another of *XyWrite*'s strengths. When you want to insert a footnote into your text, you put the cursor in the command line and type *FN*. The program then prompts you to type in the text for your footnote and hit F3 when you're finished. There are no limits on length, and you can include formatting commands. For example, you can have single-space footnotes even though your document is double-spaced. *XyWrite* numbers your footnotes automatically, starting at any number you specify, and prints them either at the bottom of the appropriate page or en masse at the end of the file, whichever you prefer. You can separate footnotes from main text with any number of blank lines or a short line of dashes, asterisks, or anything else you want to use.

To invoke boldfacing, underlining, and subscripts or superscripts, you use the control key combined with one of the number keys; to turn these features off, you hit control-0. On the monochrome display, both boldfacing and underlining are reproduced on-screen (provided you're in formatted input mode); superscripts and subscripts are in boldface.

For other special printing features (for pitch other than 10, lines per inch other than 6, and ribbon shift, for example) you have to modify your printer's setup file. This isn't as formidable a task as it sounds, but it does require you to know which escape characters your printer uses.

XyWrite allows you to gain full access to the PC's extended character set. To display the "extended" characters on-screen, you hold down the alt key and type the appropriate ASCII code. Whether you can print them, of course, depends on your printer's capabilities. To print other out-of-the-ordinary characters (slashed zeros, accented characters, and the like), you can build a substitution file that will expand any keyboard character to a string of characters on output to the printer.

File Handling. *XyWrite*'s files are of the standard ASCII type, which means that its files can be read (with a little prodding) by most standalone spelling checkers. It also means that you can use *XyWrite* as a program editor.

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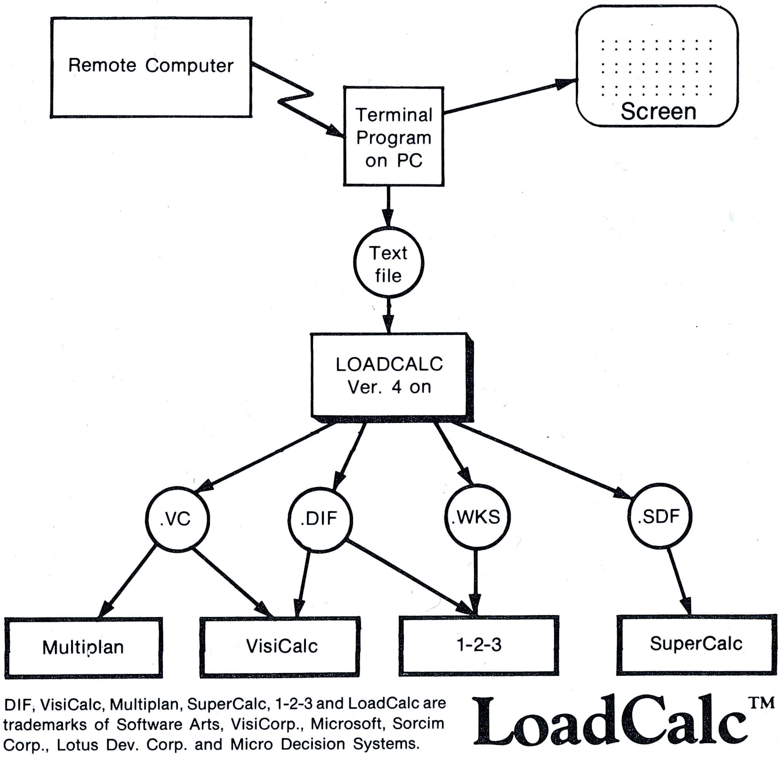

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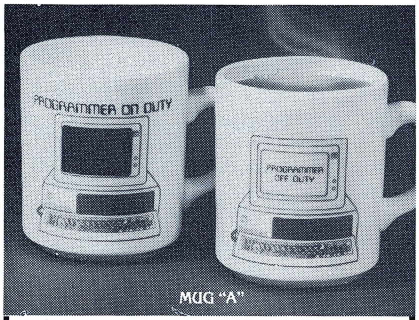
XyWrite handles files with a minimum of fuss. You can save your work and continue editing with the cursor position undisturbed. And printing your file is just a matter of going to the command line and giving the *type* command (TY) followed by the name of the file you want printed. To print what's in memory without saving it first, just omit the filename. You also have the option of printing in the background while you edit. If you have more than one printer, you can print to any of them at will by loading the appropriate printer setup file from disk.

XyWrite is geared to handle large files in a hurry. It places no limits on file size other than the amount of storage space you have on disk, but it doesn't resort to disk buffering unless it has to. Instead, it makes the most of your system's RAM, using up to the full 640K if available. This means that you can edit a 500K file (about 250 double-spaced pages) in its entirety.

If you have several shorter files (such as book chapters) you want to print as a magnum opus, you can create a master file that lists each smaller file in the order you want it printed. You can also use a master file to have several documents printed without your supervision.

Perhaps *XyWrite*'s most unusual file-handling feature is that it lets you call DOS without leaving the editor. Just go to the command line and type *DOS*; you're set to format, copy disks, or execute most other DOS commands. When you're finished, press control-break to continue editing with the cursor positioned where you left it. With DOS 2.0 this capability extends even to running other programs (spelling checkers, spreadsheets, databases, or your own Basic program) without abandoning the file in memory.



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XyWrite offers still other conveniences. You can insert often-used words, phrases, or paragraphs by defining keyboard macros. To set up a macro, you define its text as a block and assign it a key by pressing F2 followed by that key. To recall your macro, you press alt followed by the appropriate key. You can also save your macros to a permanent file; the next time you edit, just load the file into memory and your macros are ready to go again. You can store any number of such files, each of which can have up to thirty-six different phrases, one for each letter and number.

Going a step further, *XyWrite* allows you to create command macros by storing any sequence of keystrokes in a file. These keystrokes can move the cursor, initiate searches, define blocks of text, make formatting changes, and so on. In effect, such files are programs customized for your own applications; you call them by typing *run* followed by the filename.

A convenient twist of this feature allows you to create a startup program that runs every time you boot the program disk. Realizing that creating a startup program is something new users will want to do right away, XyQuest gives you some help in the form of a series of menus. By selecting numbers from these menus, you can create a program that automatically loads your printer setup file as well as your macro file if you wish. You can also indicate the default values for line spacing, margin settings, automatic paragraph indentation, page length, justification, tab settings, and so on. If you invest a little time getting this file just the way you want it, *XyWrite* will always be a couple of jumps ahead of you when you boot it.

The Extras. With its automatic indexer and table-of-contents generator, *XyWrite* ventures where few word processors have dared to go. You can either do a quick and dirty one-pass procedure in which your index and table of contents print as part of your file, or you can have each extracted as a separate file.

With both methods, you place markers in your text wherever you want something referenced. *XyWrite* gives you a choice of three different markers (X1, X2, and X3); so, if you're generating both a table of contents and an index from the same file, you can mark the index entries with X1 and the table of contents entries with X2, or vice versa.

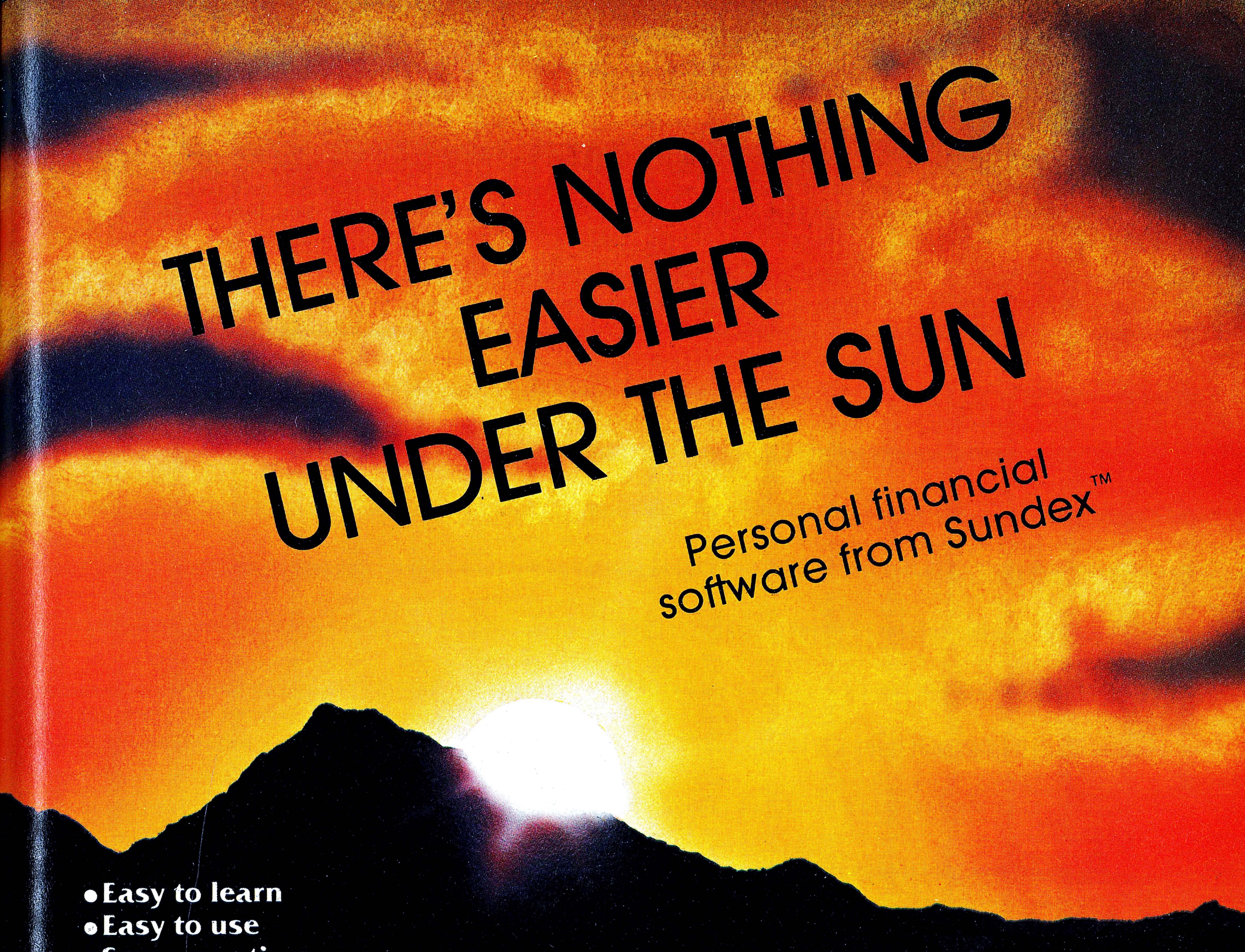
The marking process is straightforward. For each word that you want referenced, you type X1 (or X2 or X3) in the command line. Then, if you want only that word to be grabbed, just hit F3; if you want more than that word to be grabbed (as with table-of-contents entries) you type the phrase as you want it to appear. To include the same entry in both your table of contents and index, you enter a marker for both.

Once you've marked all your references, most of the work is done. All that's left is to go to the end of the file and insert formatting commands to tell *XyWrite* how you want your index and table of contents to look.

This is where you distinguish between an index and table of contents. For indexes you type *I1*, *I2*, or *I3*, matching this number to the one you used to mark entries in the text. Table-of-contents commands are similar but prefaced by a T. *XyWrite* then prompts you to enter the commands that determine, for example, line spacing, margin settings, the position of page numbers relative to text entries, and the type of leadering (a row of dots, for example). If you want your index and table of contents printed as part of your document, you're ready to print or do a preview on-screen. *XyWrite* will have sorted your index entries alphabetically and your table-of-contents entries by page number.

For long documents, you'll probably want to have your index and table of contents each printed as a separate file. By this method you can have an index accumulated from several shorter files, such as book chapters. As long as you've marked the entries in each file and inserted formatting commands in at least one of the files (preferably the last one), you can name a new target file in which *XyWrite* will accumulate all the entries with the same marker (X1, for example).

XyWrite's implementation of these features doesn't measure up to MicroPro's *StarIndex*, but then neither does its price. For starters, if you mark a word that's boldfaced or underlined in your text, *XyWrite* grabs the embedded command instead of the word itself. Another limitation is that, no matter what formatting commands you enter, *XyWrite* isn't capable of generating the kind of index you're used to seeing. It won't, for example, accumulate all the page numbers for one entry and print them together on one line. So, if you mark the word *computer* five times in your text, you'll end up with five entries in your index, each one on a separate line. Furthermore, *XyWrite* won't ignore references that occur on the same page—each of these also prints as a separate line in your index. The only way around these idiosyncrasies is to edit your index file after *XyWrite* extracts it. You'll probably want to do the same for your table of contents. These limitations notwithstanding,



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XyWrite is far superior to indexing and creating tables of contents with stacks of three-by-five cards.

Documentation and Support. *XyWrite*'s two-hundred-page manual is divided into two sections: a tutorial that, combined with sample files, takes you through most of the program's features; an alphabetically arranged reference that outlines the use of each command. Neither is long on details or examples.

Nor is XyQuest guilty of talking down to end users. On the contrary; they've written the manual as though talking to a friend, a friend who probably writes compilers for a hobby. As a result, you sometimes have to read between the lines and do some experimentation to get the features to work as you want. If all else fails, a couple of phone calls to XyQuest should solve most problems. Their advice is expert and cheerfully given (where else do you get to talk to the people who wrote the program?). The manual does have an index and a listing of error messages that includes suggestions for recovery. What's missing is a keyboard overlay or a quick-reference card to help you keep the control, shift, and alt combinations straight.

The program disk isn't copy-protected.

Ease of Learning. XyQuest would be the first to admit that *XyWrite* doesn't pamper the first-time user. Their philosophy is that training aids turn into obstacles as you become more adept with the program.

XyWrite isn't, however, completely insensitive to the new user. The basic editing and formatting functions, though not intuitive, aren't hard to learn; all the commands not assigned to the function keys are mnemonics. In situations where you need help, you can call a series of four help screens by pressing alt-F9.

There are even a few safety features. As an option, *XyWrite* will automatically make a backup file each time you store your file to disk. And, before you can save your file under an existing filename, you have to confirm your intention to overwrite the file. There are other catastrophes, however, that *XyWrite* doesn't ensure against. For instance, you get no warning if you quit the program without saving your work or if you clear the current file from memory.

Efficiency of Use. Once you've memorized the commands and solved some of the mysteries in the manual, *XyWrite*'s lean structure starts to pay off. From the editing screen, all the program's features are just a command away. The only inconsistency seems to be the extra step required in printing your file to the screen, a roadblock for those who like to rearrange page breaks.

Audience. XyQuest knows its audience, and that audience doesn't include the person who wants to learn a word processor in fifteen minutes. On the other hand, if you're at all technically inclined or you just like to tinker, this is a program you can mold to your needs.

System Requirements. *XyWrite II* requires one disk drive and 96K of memory, with 128K recommended. It runs on most of the IBM-compatibles. The program disk has printer tables for more than twenty popular printers, and XyQuest will furnish tables for other printers if you send them a copy of your printer manual.

XyWrite II (version 1.2) $195
XyQuest Inc.
Box 372
Bedford, MA 01730
(617) 275-4439

Coming Attractions. Next month we'll do an about-face and look at *WordVision*, a program that indeed pampers the first-time user. We'll also look at *Word Proof*, a combination spelling checker, thesaurus, mini-word processor, and anagram solver brought to you by Big Blue. ▲

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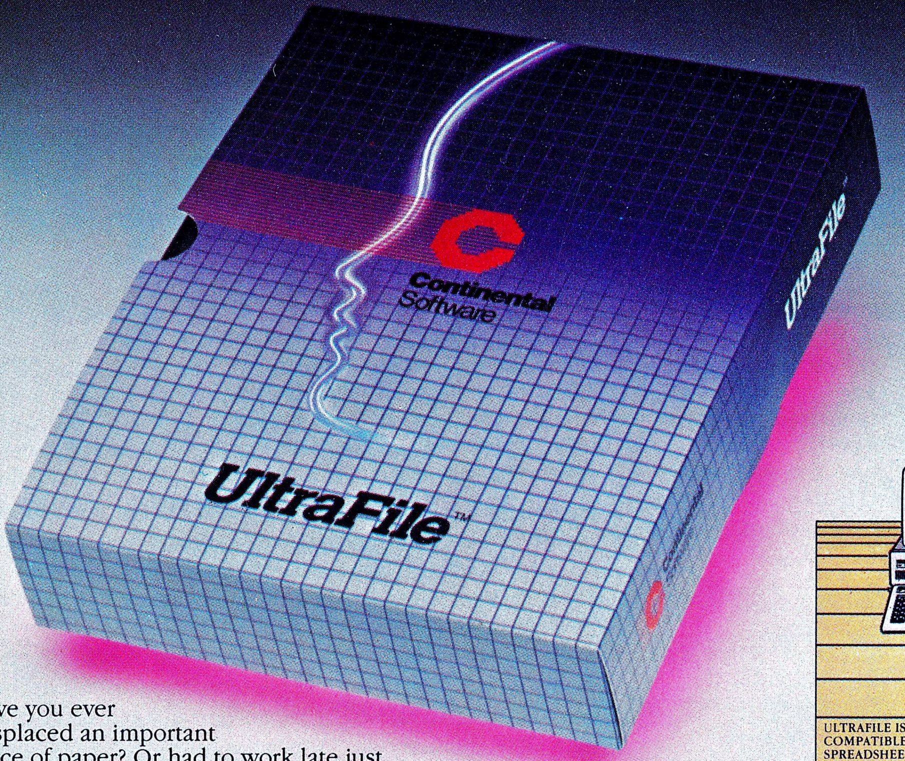

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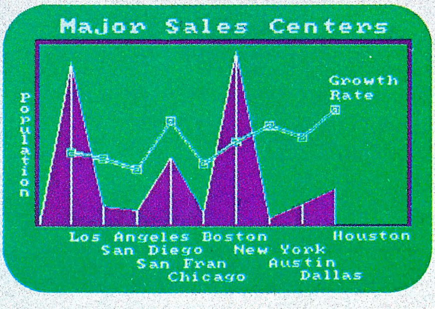

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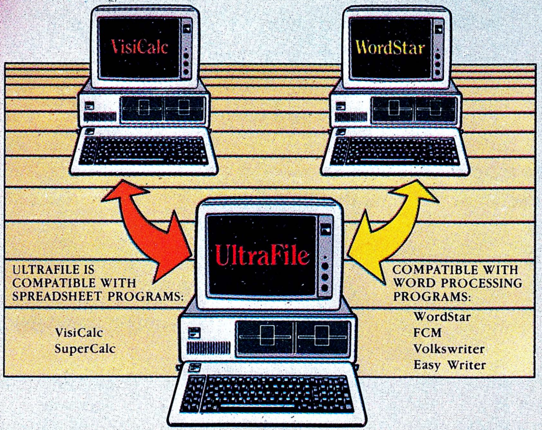
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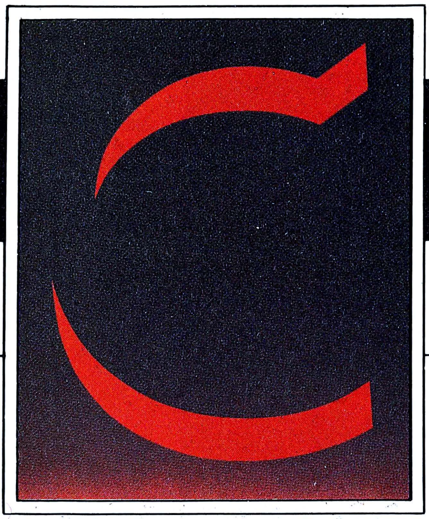
THE C SPOT

by Rex Jaeschke



More Branching and Looping; Arrays

Last month we began our look at methods of implementing conditional and unconditional branching and looping in C. In this installment, we will learn about yet another looping construct and then see how to define and use character and numeric arrays.

The *for* Construct. Another method of loop processing is the *for* statement.

```
/* --- for1.c   The for construct --- */
main ()
{
        int i;
        printf ("i (dec)\ti (hex)\t~i (hex)\n\n");
        for (i = -3; i <= 3; ++i)
                printf("%2d\t%4x\t%4x\n",i,i,~i);
        printf ("\nAt the end of the loop, i is %d.\n",i);
}
```

The output produced is

```
i (dec)         i (hex) ~i (hex)
-3              FFFD        2
-2              FFFE        1
-1              FFFF        0
0                  0     FFFF
1                  1     FFFE
2                  2     FFFD
3                  3     FFFC
```

At the end of the loop, *i* is 4.

A *for* statement has three parts, separated by semicolons. In this example the first part, *i = −3;* is the initialization and is executed once before the loop is entered. The second part, *i <= 3;* is the condition that controls the loop. If this condition is true, the body of the loop is executed and then the third part, *++i*, is executed and the condition is tested again. The loop terminates when the second part condition is false.

In this example, the body of the loop is only one statement and therefore doesn't need to be enclosed in braces, although it could be. Like the *while* statement, *for* does not execute the loop at all if the test condition is initially false. The controlling variable *i* retains its value after the loop is terminated; in this case *i* = 4.

Until now, numbers printed using *printf* have been left-justified. In this example we see two new edit masks, *%2d* and *%4x*. The *%2d* causes the second argument, *i*, to be printed as a decimal value right-justified with a width of two characters. *%4x* causes the third and fourth arguments to be printed in hexadecimal format, width four. As *i* is a sixteen-bit integer, only four hex digits are required. Note that the size of *i* may not necessarily be sixteen bits on other machines. The ~ symbol is the one's complement operator.

The preceding example can be written as

```
/* --- for2.c   The for construct with a null body --- */
main ()
{
        int i;
        printf ("i (dec)\ti (hex)\t~i (hex)\n\n");
        for (i = -3; i <= 3;
printf("%2d\t%4x\t%4x\n",i,i,~i),++i)
                ;
        printf ("\nAt the end of the loop, i is %d.\n",i);
}
```

Here all the work is done in the *for* statement itself and no loop body is needed. However, the *for* construct requires at least one statement in the loop body and so *;* appears on its own. This signifies the null, or empty, statement. It is wise to place the null statement on its own line to make its presence obvious.

for2.c shows the third part of the *for* construct as having two subparts: the *printf* function call and the increment statement. These two statements are separated by the comma operator and are evaluated left to right. The commas used to separate function call arguments and variable declarations are *not* comma operators, and their order of evaluation is therefore not guaranteed. The first part may also contain more than one initialization statement.

The three parts of the *for* statement are really expressions, and although in the above example they all refer to the variable *i*, they need have no common connection. Parts 1 and 3 are optional. If part 2 is omitted, the loop becomes "infinite." *for (;;)* { ... } is equivalent to *while (1)* { ... }. Such an infinite loop may be exited by use of the break or return statement.

The *if/else* Construct. The most common way to test the value of a variable or expression is to use the *if* statement with optional *else* clause.

```
/* --- if1.c The if/else construct and break statement --- */
main ()
{
                int reply;
                while (1) {
                        printf ("\nHave you ever programmed in C? (Y/N) ");
                        reply = getchar();
                        if (reply == 'y' || reply == 'Y') {
                                printf ("\nThen skip the introductory lessons.\n");
                                break;
                        }
                        else if (reply == 'n' || reply == 'N') {
                                printf ("\nWelcome to the world of C.\n");
                                break;
                        }
```

Come in late on "The C Spot"? All back issues of the column—from January 1984—are still available; for further information, see page 4.

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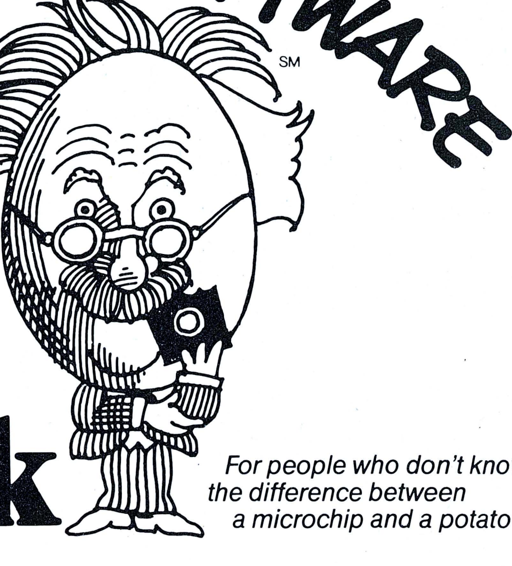

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```
                else
                        printf ("\nInvalid reply. Please try again.\n");
        }
        printf ("\nThanks for your cooperation.\n");
}
```

Here are examples of output produced by this program:

```
Have you ever programmed in C? (Y/N) g
Invalid reply. Please try again.

Have you ever programmed in C? (Y/N) y
Then skip the introductory lessons.

Thanks for your cooperation.

Have you ever programmed in C? (Y/N) N
Welcome to the world of C.

Thanks for your cooperation.
```

The condition *while (1)* is, by definition, always true. Therefore the body of this loop will be executed indefinitely unless it is terminated by some other means. The loop body is a compound statement consisting of the call to *printf*, an assignment to *reply*, and an *if* statement. Note that the *else* clause of the first *if* test contains another *if* test. *if*s can be nested up to a compiler-defined depth.

Both *if* tests contain a compound expression. ¦¦ is the logical OR operator. ¦¦ operator groups are evaluated left to right. && is used as the logical AND operator and takes precedence over ¦¦ if both are used in an expression. You can alter the order in which expressions are evaluated by using parentheses. Note that the equality operator is ==, while = is reserved for assignment purposes only.

The body of both *if* statements is enclosed in braces, as there is more than one statement to be executed. The final *else* has only one statement and therefore does not need braces—although they could be used.

The break statement causes termination of the innermost current *while*, *for*, *do*, or *switch* loop. Control passes to the statement following the end of the loop construct—in this case, to the *printf* function call that thanks the user.

getchar() gets one character from standard input and does not wait for or require the user to press return or enter. Hence, the current cursor position is that immediately following the character input. To ensure that their message is printed on the next line, the three *printf* function calls within the *if/else* construct print a *newline* prior to printing their message.

'Y' is a character constant that produces an integer equal to the numerical value of Y in the machine's character set. In the ASCII set this value is 89. *'Y'* is preferred to 89, as its meaning is more obvious and is machine-independent. The escape sequences used in the *printf* function edit mask are also single-character constants. As we have seen, these include *'\n'*, *'\t'*, and *'\b'*. Note: *'Y'* is a single-character equivalent to an integer, while *"Y"* is a character array consisting of one character. They are not the same.

Several other less-used constructs are available for implementing looping and branching. These are *do-while*, *switch*, and the inevitable *goto*. These will be covered in future installments as space permits.

Arrays. C has no means of dealing with character strings directly. It can, however, handle single characters and arrays of characters. Dealing with character strings (such as names and addresses) as arrays seems clumsy to programmers used to the group move and compare capabilities found in Basic, Cobol, and Fortran-77. As group move and compare functions are easily written in C and generally are provided by the compiler vendor, the C disciple probably doesn't miss them. However, the fact remains that needing to call a subroutine to implement these capabilities is foreign to most commercial (and Basic) programmers and is a psychological obstacle that they must overcome to use C.

Let's look at a simple example where the user's name is read from standard input and stored into a character array.

```
#define EOL '\r'                  /* end-of-line marker is a CR, ascii code 13 */
#define EOS '\0'                  /* end-of-string marker is a null, ascii code 0 */
#define MAXLEN 30                 /* maximum length of name is 30 */
#define MAXSIZE MAXLEN+1 /*  maximum size of name array is MAXLEN+1 (or 31) */
/* --- array.c  Introduce character arrays --- */

main ()
{
        char name[MAXSIZE];
        int c,i = 0;

        printf ("Please enter your name (30 chars max). ");
        while (i < MAXLEN && (c = getchar()) != EOL)
                name[i++] = c;

        name[i] = EOS;
        printf ("\n\nPleased to meet you %s.\n",name);
}
```

produces

```
Please enter your name (30 chars max). john brown

Pleased to meet you john brown.
```

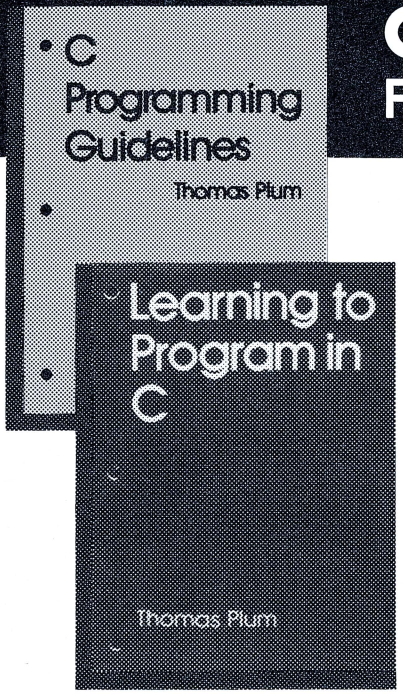
The *#define* preprocessor directives assign string values to each of four compile-time constants. Remember, *EOL, EOS, MAXLEN,* and *MAXSIZE* are not variables; they are like macros that are expanded at compile time into their assigned character values. That is, *EOL* is equivalent to the four characters '\r'. Each occurrence of *EOL* in the source program is replaced by these four characters before being processed by the compiler. Note how *MAXSIZE* is assigned a value of *MAXLEN+1*. A compile-time constant can be a function of other such constants provided that any constants referenced have been defined previously. Some C compilers permit compile-time constants to be referenced before they are defined. Use of this "feature," however, may impact portability between compilers.

char name[MAXSIZE] declares *name* to be an array of thirty-one characters. Array subscripts always start at 0, so the elements of *name* may be referenced as *name[0], name[1] ... name[30]*. A subscript can be any expression that reduces to an integer. C provides no subscript range-checking at runtime, nor does it allow subscripts to begin at other than 0. Variable size arrays are not permitted. Space for automatic variable arrays is allocated at runtime and remains fixed throughout a program. It is the programmer's responsibility to ensure that a subscript value is valid. Results will be unpredictable if an array subscript is less than 0 or greater than the array length.

If we have decided on a maximum length of thirty for *name*, then why have we dimensioned *name* to thirty-one? C allows character arrays of any length. A character array must always be terminated with a null character *'\0'*, which has a binary value of 0. Unless a routine knows how long a string is beforehand, the terminating null is necessary to tell it that the complete string has been processed. String lengths are not stored by the compiler and must be calculated at runtime by the user. The null character is not and cannot be part of the data string. However, storage space must be provided for it. Therefore, an array of thirty-one characters is required to store a thirty-character name with trailing null.

int i = 0; defines and initializes the integer variable *i*, which is used as a subscript to array *name*. This saves an extra statement but may obscure the initializing process. This statement is equivalent to *int i; i = 0;* and should generate the same code.

array.c gets characters one at a time from standard input and stores them into the array *name* until either thirty characters ([0] — [29]) have



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been read or a carriage return is entered. Notice how the array subscript *i* is post-incremented to ensure that the incoming characters are stored properly. We have used *EOL* to represent end-of-line, which for the PC is the carriage return character (ASCII 13). The character constant *'\r'* provided by C is equivalent to a carriage return. Throughout Kernighan and Ritchie, *'\n'* (the newline character) is used as end-of-line. This is true for Unix systems; but on the PC, the return key generates a *'\r'*. Using a compile-time constant avoids this system dependence.

After the *while* loop terminates, a trailing null character is added to indicate the end of the character string. Again we have used a compile-time constant—in this case, *EOS*. This makes the code more readable and more likely to be portable. If *EOL* is the first character entered, the *while* loop body is never executed and the null is stored in *name[0]*. The string name therefore consists of \0 only and has a length of 0. If the name JOHN is entered, it will be stored as J O H N \0. In this case the string is four characters long.

In this example, the name is not padded out with spaces (although the programmer could choose to do so). *array.c* treats leading and trailing spaces as significant. Indeed, all characters input, whether printable or not, are significant, because no validation is done.

The name string is displayed on standard output by *printf*, using an edit mask of *%s*. This prints characters from the string name until a null character is found. If a null is not present at the end of a character string, any program processing that string will keep right on going until it finds one. The programmer is responsible for ensuring that character arrays are properly terminated with a *'\0'*.

The literal text strings used as the first arguments in *printf* function calls are stored as character arrays by the compiler. In *array.c* the *printf* literals are stored as follows. Note the trailing null characters.

```
label1 DB 'Please enter your name (30 chars max). ',0
label2 DB 10,10,'Pleased to meet you %s.',10,0
```

Earlier, we briefly mentioned the difference between *'Y'* and *"Y"*. *'Y'* is an integer constant that has the value of Y in the machine's character set (the ASCII representation for *'Y'* is 89), while *"Y"* is a character array of length 1. *"Y"* is stored as Y \0.

Let's clean up *array.c* a little by adding some elementary input validation.

```
#define EOL '\r'              /* end-of-line marker is a CR, ascii code 13 */
#define EOS '\0'              /* end-of-string marker is a null, ascii code 0 */
#define MAXLEN 30             /* maximum length of name is 30 */
#define MAXSIZE MAXLEN+1      /* maximum size of array is MAXLEN+1 (or 31) */
#define SPACE ' '
#define TAB '\t'

/* --- array1.c  Read a character string ignoring leading spaces and
                 tabs and replace embedded tabs with spaces --- */

main ()
{
        char name[MAXSIZE];
        int c,i = 0;

        printf ("Please enter your name (30 chars max). ");
        while ((c = getchar()) == SPACE ¦¦ c == TAB)   /* discard leading */
            ;                                           /* spaces and tabs */
        while (i < MAXLEN && c != EOL) {
            if (c == TAB)
                 name[i++] = SPACE; /* convert inline tab to space */
            else
                 name[i++] = c;
            c = getchar();
        }
        name[i] = EOS;
        printf ("\n\nPleased to meet you %s.\n",name);
        printf ("\nThe length of your name is %d characters.\n",i);
}
```

```
Please enter your name (30 chars max).

Pleased to meet you.

The length of your name is 0 characters.

Please enter your name (30 chars max).        John   Smith

Pleased to meet you John Smith.

The length of your name is 10 characters.
```

Note that inputting *EOL* on its own is handled correctly and that leading white space is ignored and embedded tabs are converted to spaces. The first *while* statement reads and ignores all leading tabs and spaces. Although all the work is done in the condition evaluation, the *while* construct requires a loop body, so the null statement *;* must be used. Putting it on its own line makes it more obvious.

Other data types may be stored in arrays. *int val[10]* declares an integer array named *val* that can be referenced as *val[0]*, *val[1]* . . . *val[9]*. The null character is used only to terminate character arrays. Noncharacter-type arrays have a fixed amount of storage allocated based on the maximum number of array elements declared and the size of each element. The following code defines and initializes a fifteen-element double-precision array.

```
int i;
double darray[15];

for (i = 0; i < 15; darray[i++] = 0.0)
    ;
```

As an exercise, modify *array1.c* to ignore all but uppercase and lowercase characters and spaces. Convert all tabs to spaces, and reduce consecutive spaces to only one space. Ignore all leading and trailing spaces and tabs. ▲

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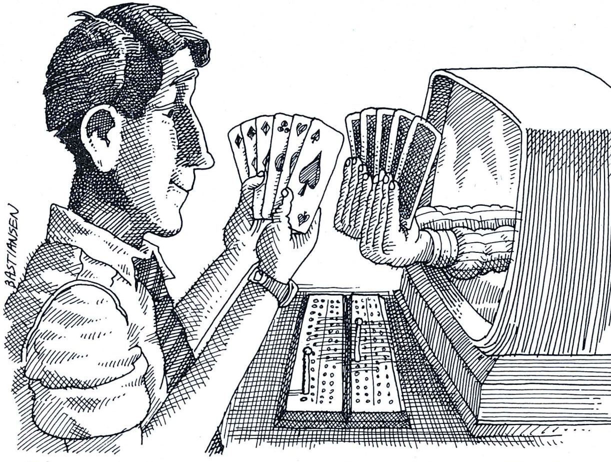

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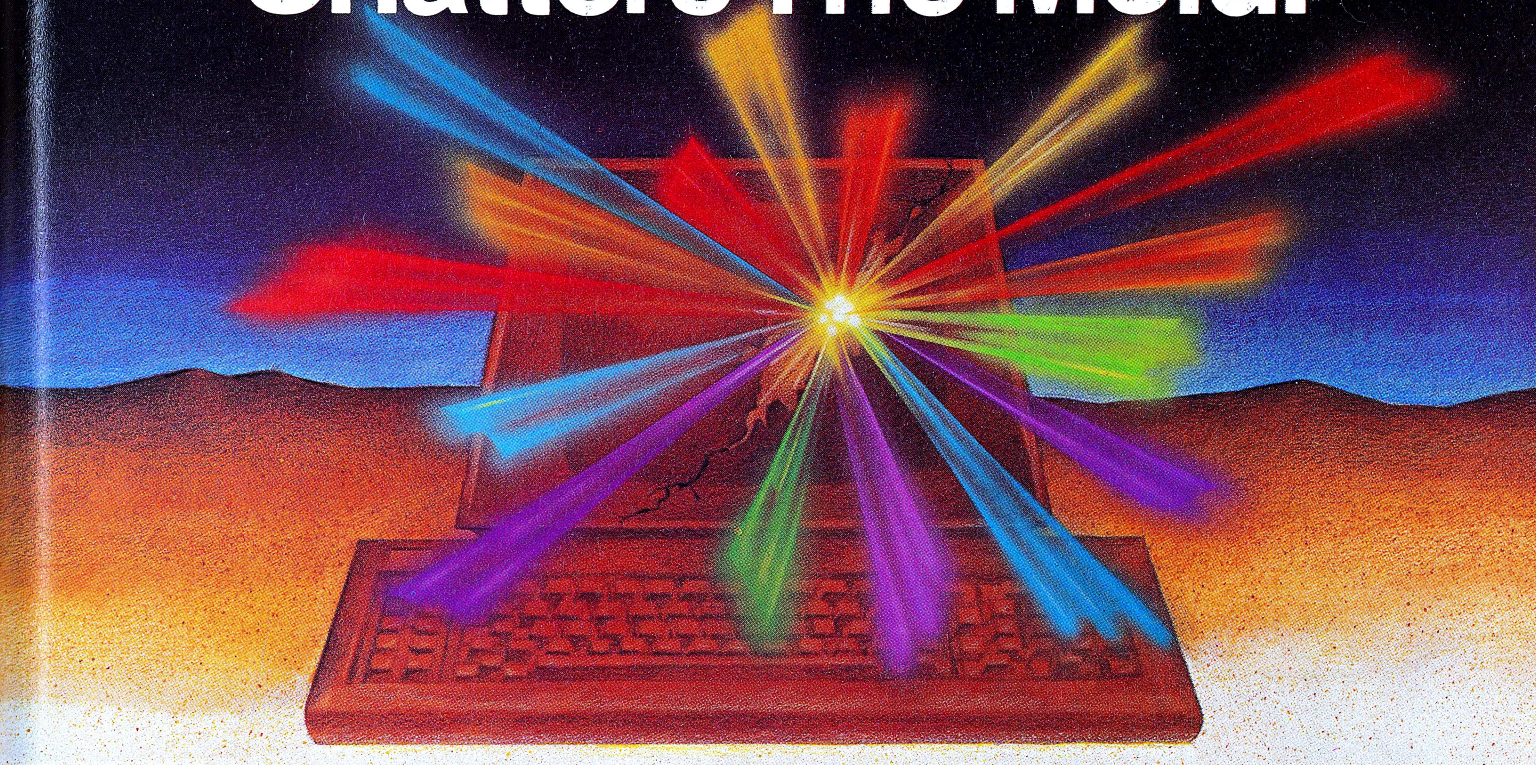

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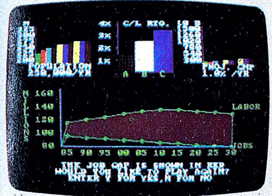

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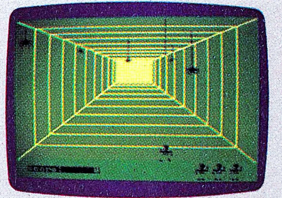

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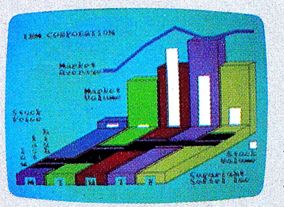

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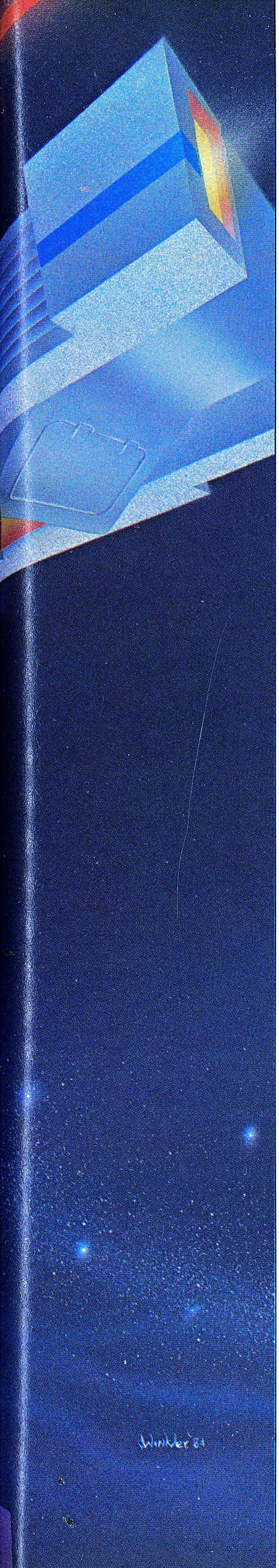

TELEGAMING

A SURVEY OF ON-LINE GAMING OPPORTUNITIES

BY PATRICIA FITZGIBBONS

What's that you say, Bunky? Your spreadsheet program has you filling in rows and columns in your sleep? You've had a modem for six months, but the only telephone numbers you know are your own and Dow Jones's? You can't play *Galactic Wars* during your lunch break because the mainframe at work doesn't know how? Cheer up, Bunky . . . help is on the way! Get a communications package for your PC and start dialing!

THE MODEM CONNECTION

BEGINNING AS AN underground pastime among burned-out hackers, telegaming has become an increasingly sophisticated and popular activity for thousands of personal computer owners. As more people acquire modems to connect their computers to remote systems, telecommunications services are offering more on-line gaming opportunities to both casual and serious gamers. The options range from standard single-player games, such as blackjack, to vast multiplayer war simulations with color graphics. Today, gamers' on-line choices are limited only by their preferences and budgets.

THE BIG SERVICES

THE SOURCE AND CompuServe—with, respectively, about forty thousand and one hundred thousand subscribers—are the largest telecommunications services offering games to consumers. Subscriptions to these networks are available at most computer stores. Connect charges begin at $6 per hour of on-line time, depending on the service, time of day, and your modem's baud rate.

THE SOURCE. The Source's game library includes almost seventy single-player (you versus a mainframe) computer games. There are dungeon adventures such as *Castlequest* and *Blackdragon*, shoot-'em-ups such as *Star Trek* and *Target*, casino games, and computer versions of backgammon, football, and checkers. Source subscribers may also participate in the play-by-electronic-mail (PBEM) games of *Diplomacy* and Flying Buffalo's *Starweb*. Since The Source does not yet offer multiplayer computer games—games in which many remote users play simultaneously—the PBEM games give strangers the opportunity to become friendly on-line opponents in human-moderated games.

Source gamers also use their own electronic bulletin board to request hints or offer advice about home computer games. Here is an example of one message that appeared on the The Source's Post Games board:

> **Category:GAMES Subject:HELP WITH ULYSSES From:ST2022 Posted:26 DEC 10:09 pm We have gotten by the skeletons and are at the cliff where you hear the horse. How do you find Pegasus? We have the enchanted mallet and have gotten by the Cyclops, but are stuck on what to do next. Ted**

Other gamers reading Ted's message can send him advice using The Source's electronic mail system.

Recently, The Source introduced its *Sourcelink* communications program for the IBM PC. PC owners with 128K, a color/graphics board, and color monitor can use *Sourcelink* to receive color graphics from many of the network's services, including games.

Other game-related offerings on The Source are Teleresource, Vault of Ages, and Crossword Puzzles, all stored in the User Publishing databases. Teleresource users may download game programs directly to their own disks; Vault readers can locate hints for the computer game *Time Zone*; and crossword fans can find questions and answers in the Puzzles files.

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COMPUSERVE.

The CompuServe games menu lists over forty computer games as well as a Gamers' Special Interest Group (GameSIG), the GameSIG Archives database, and a Multiplayer Special Interest Group (MPSIG).

Among the single-player games on CompuServe, some of the most popular are dungeon quests: *New Adventure*, *House of Banshi*, and *Castle Telengard*. Text versions of nine Scott Adams adventures, ranging from "easy" to "difficult," are also on-line for subscribers' enjoyment (and frustration!). The *save game* function allows players to quit at any time and return later to their previous game positions.

Naturally, CompuServe offers such single-player standbys as *Star Trek*, *Eliza*, and *Hangman*, but the area in which CompuServe leaps ahead of competitors is multiplayer games. Because multiplayer, multiterminal computer games are complex and therefore costly to design and produce, very few are in existence at the moment. However, on CompuServe, thousands of subscribers meet electronically, week after week, to play a variety of multiplayer games. One game in particular, *MegaWars*, has developed a cult of devoted fans.

MegaWars is a real-time space war simulation in which ten-member teams battle for control of a future universe. Whether they decide to fight alongside peace-loving Colonists or vicious Kryons, players' imaginations, experience, and concentration are sorely tested. Pregame conferences and scrimmages are held by teammates in CompuServe's MPSIG, and "MegaWarriors" use MPSIG's electronic bulletin board to exchange strategy tips, schedule new games, and issue challenges to opposing teams.

Four versions of *MegaWars* are currently online. Users of CompuServe's *Vidtex* terminal program can obtain sound and color graphics with *MegaWars II*, and a total of eight gamers may take part in each battle. Using their ships' phasers and energy shields, two teams simultaneously clash in space while the lowest line of each player's screen displays communications from other ships or planets.

MegaWars III simulates humanity's expansion into far corners of the galaxy. The emphasis here is on exploration and colonization rather than on combat. *MegaWars III* involves the manipulation of populations and economies and is an excellent example of what CompuServe's product manager, Bill Louden, calls "a thinking game."

Other multiplayer computer games available on CompuServe are *DecWars* (for up to ten players), *Space War* (for up to eight players), and *MP Blackjack*. The CompuServe Casino offers such single-player games of chance as craps and roulette, but multiplayer blackjack draws gamblers to the tables more often than any other casino game. Starting with one thousand gaming credits from the friendly cashier, customers take seats at any of the four-player tables and cross their fingers. Either the house or a customer deals, and spectators can kibitz among themselves by typing *K* and then a one-line message directed to a friend. Rumor has it that several "back counters" and "big players" have been spotted lurking in the *MP Blackjack* section of the casino.

Single-terminal, multiplayer games—in which several people at the same computer take turns with CompuServe's DEC PDP-11—are on-line as well. These include *Fantasy*, *Scramble*, *Backgammon*, *Concentration*, and *Football*. While CompuServe's mainframe acts as playing field and scorekeeper, each player enters his or her move. Of course, all these games may be played in solitaire mode or against remote opponents, but it's often more fun to draw up two chairs in front of a PC and play *Fantasy* with a friend.

MULTIPLAYER GAMES

achieve a new level of social interaction on CompuServe's GameSIG. Although almost any traditional board game can be modified for play via GameSIG's bulletin board or multiuser conference area, the most popular choices have been fantasy role-playing games, chess, *Diplomacy*, and *Monopoly*.

With more than six thousand members from the United States and Canada, GameSIG's real-time or PBEM games are an important part of CompuServe's gaming lineup. Usually these activities are organized by a game master who solicits players by posting a message on GameSIG's public bulletin board. Then, when a group is formed, a schedule is agreed upon and play commences. Fantasy role-playing games such as *Dungeons and Dragons* are held nightly in the conference (CO) area and via the message board. Using the CO program's dice function, participants roll for their characters' attribute scores, hit points, and combat results. Here is an excerpt from the transcript of an on-line *D&D* game:

(DM) Two hideous, human-like creatures enter the room. They emit a foul odor and have red, glaring eyes. As soon as they see you, they stop for a moment.

(Eammon) I run to attack with my sword.

(Raewald) I'll shoot an arrow.

(DM) They are five feet away from you, Raewald. Roll to hit, Eammon.

(*DICE***) 14/20**

(DM) Eammon strikes one of the creatures. It is a mighty blow and the ghoul staggers backward.

(Raewald) Religious types! Drive them off!

(Alanon) I get out my mistletoe.

(DM) A ghoul advances upon Adric.

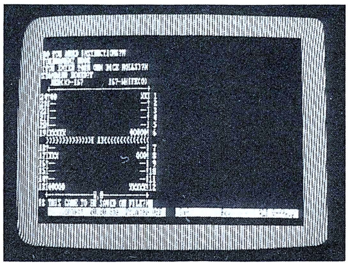
(Adric) I attack with my two-handed sword.

(DM) Roll to hit, Adric.

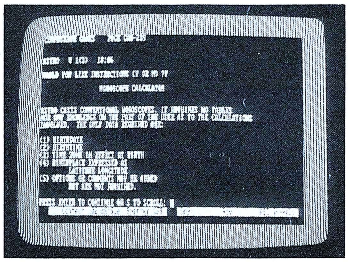
(*DICE***) 1/20**

(DM) Adric misses. The creature claws him, doing three hit points of damage.

MEGAWARS IS A REAL-TIME SPACE WAR SIMULATION IN WHICH TEN-MEMBER TEAMS BATTLE FOR CONTROL OF A FUTURE UNIVERSE.



BACKGAMMON



HOROSCOPE CALCULATOR

ONE OF THE MOST POPULAR COMPUTER GAMES, *ZORK II* BY INFOCOM, IS AN ALMOST CONSTANT TOPIC OF DISCUSSION.

(Alanon) I shall hold forth my mistletoe and tell these nasty undead to be gone!
(DM) The two ghouls stare at Alanon in horror. Then, they begin to shriek at him and back into the northwest corner of the room, by the monk's bones.
(Alanon) Hah!

Continuing real-time fantasy role-playing games are enjoyed by groups of players as far apart as New York and Hawaii. Most participants are in their twenties or thirties, but teenagers and older people have also joined in these electronic quests for treasure and excitement. Transcripts of past gaming sessions are stored in GameSIG's database area for all members to read at their leisure.

THE FIRST ON-LINE chess tournament, which ran from May through December of last year on GameSIG's bulletin board, was an enormous success among the "chessnuts." Participants included high-ranked U.S. Chess Federation members as well as novices. The players kept track of their moves on their own chess boards at home, and a tournament director supervised the five rounds. Ever since the tourney ended, chess fans have enthusiastically continued to challenge each other. Using GameSIG's bulletin board, opponents post their moves in messages such as this one:

#: 44936 Sec. 4 - Chess
Sb: #NEW GAME
27-Dec-83 15:36:23
Fm: RICK GEORGES 72465,1311
To: TING F. LEE 73415,1617 (X)

Hi! Had a good Xmas, but we're having N.Y. weather here. Got down to 25. Brrr!! Never been this cold before. Going to Disney World tomorrow. Having a great time. Wish you were here. 14. QN-Q5 NxN And, yes, I see the threatened N-KN5, but I don't think you can do it! *RICK*

Diplomacy players also use the bulletin board to exchange messages. Russell Sipe, an experienced game master from Anaheim, California, runs "Dippy" games on The Source and CompuServe. Sipe publishes all game results in *The Armchair Diplomat*, his weekly on-line journal of PBEM games. Along with status reports and deadline information, Sipe includes delightful "press releases":

> FRANCE
> LE MONOCLE—GALLANT FREEDOM FIGHTERS FROM THE FRENCH RESISTANCE MOVEMENT BRAVELY BLEW UP AN OUTHOUSE OUTSIDE OF BARCELONA RUMORED TO BE FREQUENTED BY THE GERMAN HIGH COMMAND. AN ELECTRIC FAN NEARBY WAS INUNDATED WITH A HERETOFORE UNIDENTIFIED SUBSTANCE, AND ONE GERMAN GENERAL WAS QUOTED AS SAYING THAT THE 'BLEEP' HAD HIT THE FAN. THE GERMAN EMBASSY REFUSED TO DIGNIFY THE REMARK AND ACCUSED THE FRENCH OF WASTING VALUABLE VINTAGE PORT IN THEIR FUTILE TERRORIST ATTACKS.

Secret negotiations are easily handled by players because the bulletin board provides a private message function. It is not unheard of, however, for a negotiator to "unintentionally" post a seemingly "private" message publicly. Such is the stuff of international intrigue.

Monopoly, as well as bridge and other card or board games, is played by using GameSIG's dice-rolling function in the multiuser conference area. Although standard rules have been modified for on-line use, players quickly become accustomed to the electronic versions of their traditional favorites. *Monopoly* players, for example, download a list of game cards from a file in GameSIG's database area. Then, they go to the CO area and roll the dice in order to identify the cards that guide their moves. A referee notes amounts of money exchanged and properties purchased, while each player keeps an eye on a game board (usually set up next to his or her computer).

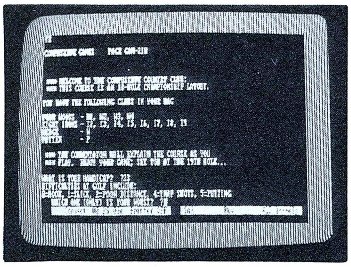
Along with its scheduled multiplayer games, GameSIG provides a forum in which members exchange gaming hints, reviews, and industry news. One of the most popular computer games, *Zork II* by Infocom, is an almost constant topic of discussion:

#: 44952 Sec. 1 - Adventure Games
Sb: ZORK II
27-Dec-83 17:46:17
Fm: Tristero 73775,430
To: Mark Brink 75155,1441 (X)

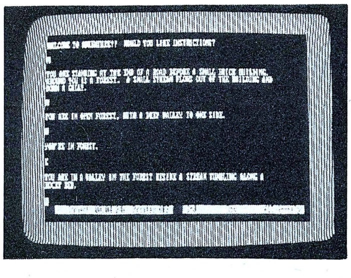
Mark—The lizard has a sweet tooth and has been guarding for a long time. The brick is really a special type of plastic (if you need more help, try burning it—but save the game first!). To get past the Menhir, you need to be as powerful as the Wizard, and that will take a while.

The permanent GameSIG Archives database area contains complete, step-by-step solutions (*walkthrus*) of dozens of computer adventure games, as well as an upcoming events file and the *Gamer's Gazette*; the *Gazette* contains articles on topics as varied as the invention of *Monopoly* and the successful marketing of computer games.

Besides its on-line games, GameSIG, and MP-SIG, CompuServe provides PC users with their own special-interest group. The IBM PC SIG has dedicated one of its bulletin board sections and database file areas to "Fun & Games" and offers over sixty entertainment programs to its members for downloading. One popular program modifies a flight simulator game so that it may be played in color on an RGB monitor. Other offerings include a music program that beeps out the *William Tell*



GOLF



ADVENTURE*
(*The original 1975 mainframe version by Will Crowther and Don Woods.)

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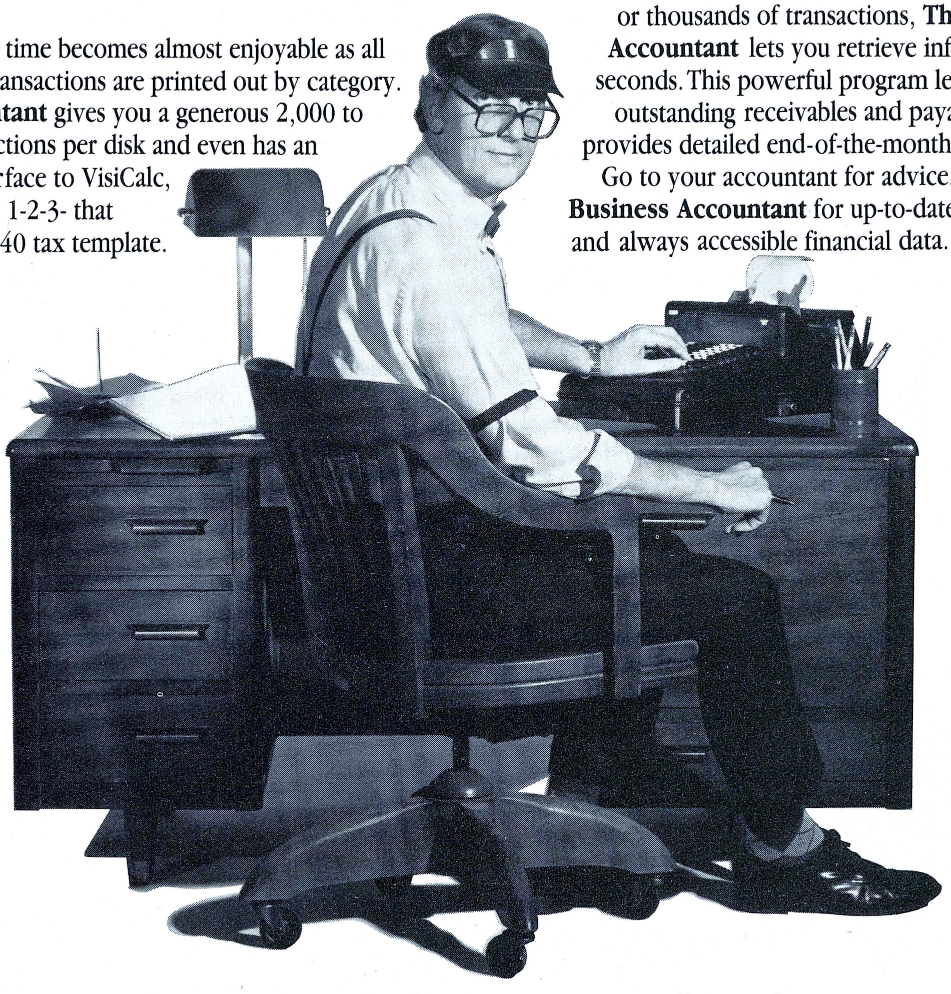

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TIME AND DISTANCE WILL DISAPPEAR AS PEOPLE SEPARATED BY THOUSANDS OF MILES MEET ON-LINE TO NEGOTIATE, GAMBLE, AND SHARE ADVENTURES.

Overture, games for use with a light pen, and a compiler that allows users to create their own adventure games. All programs are in the public domain and are free to IBM PC SIG members. For the price of a CompuServe subscription and a few hours of on-line time, PC owners can download an extensive library of game files.

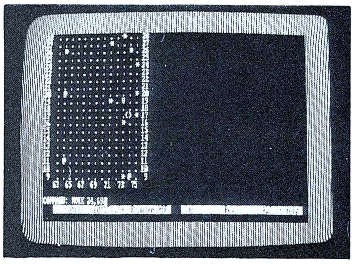
MEDIUM-SIZED NETWORKS

ALTHOUGH THE SOURCE and CompuServe are the giants of the telegaming field, other smaller subscription systems also offer a number of exciting on-line games. Among these systems are GameMaster, Plato, and Delphi.

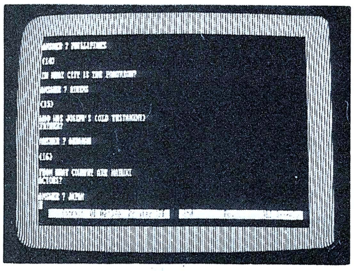
GameMaster, a multiline gaming system located in Evanston, Illinois, is set up as an electronic "mansion" with dozens of "rooms." Adventures such as *Eamon* are played in the Time Room, visitors to the War Room sample simulations such as *Nuke Strike* and *Destination Midway*, and Club Room guests choose from a variety of casino-style entertainments. The strategic science fiction game of *Empyrean Challenge* allows up to 150 players to participate in one campaign. For Chicago-area residents, GameMaster connect charges are only $3 per hour. Long-distance callers, however, must add on the cost of dialing into Evanston.

The Plato system, originally developed as an educational experiment by the University of Illinois at Champaign-Urbana, is now owned by Control Data Corporation. Although most subscribers use Plato's dedicated terminals, CDC has recently introduced its *Homelink* software for IBM PC owners with 64K and a color/graphics board. Thirty interactive computer games are available, including *The Mines of Moria*, a graphic adventure; *Empire*, which allows up to thirty players in four teams to roam a hostile universe; and *Roll 'Em*, a dice game in which callers compete for the best score. Network time is $5 per hour.

General Videotex Corporation's Delphi system is located in Cambridge, Massachusetts. Along with electronic bulletin boards, mail, and databases, Delphi offers more than thirty on-line games. Such standards as backgammon and *Wumpus* are available, as is the popular *Dungeons* adventure quest. Connect charges for non-prime-time hours are $6 per hour.



DECWARS



TRIVIA

PRIVATE BULLETIN BOARD SYSTEMS

OF THE HUNDREDS of computerized bulletin board systems (BBSs) in operation throughout the country, dozens are dedicated to game-related topics and game playing. While some of these systems are primarily used by callers to participate in PBEM fantasy role-playing adventures, others offer single-player interactive computer games and/or programs for downloading. The individuals who own and operate BBSs occasionally charge nominal fees for access to their systems or program files. However, most BBSs are free and make a variety of gaming opportunities available for the cost of a local or long-distance telephone call.

Lists of BBS numbers are available on CompuServe (GameSIG and IBM PC SIG both have these files in their database areas), on The Source (in the User Publishing section), and on the People's Message System BBS in Santee, California (619-561-7277). Here is a brief list of some of the best gaming BBSs and their modem numbers:

Big-Top Games System: (414) 259-9475 (Milwaukee, WI)
Dragon's Lair: (213) 428-5205 (Long Beach, CA)
Drucom BBS: (215) 855-3809 (North Wales, PA)
Ed Gelb's Data Base: (201) 694-7425 (Wayne, NJ)
IBM PC BBS: (301) 937-4339 (Beltsville, MD)
IBM PC RCP/M RBBS: (213) 973-2374 (Hawthorne, CA)
Lethbridge Game System: (403) 320-6923 (Alberta, Canada)
The Mages BBS: (402) 734-4748 (Omaha, NE)
Magnetic Fantasies: (213) 388-5198 (Los Angeles, CA)
The Mines of Moria: (408) 688-9629 (Aptos, CA)
The Mines of Moria: (713) 871-8577 (Houston, TX)
Nessy: (312) 773-3308 (Chicago, IL)
Sunrise Omega-80: (415) 452-0350 (Oakland, CA)
Teledunjon III: (214) 960-7654 (Dallas, TX)
White Pegasus: (214) 680-9322 (Dallas, TX)

Since most BBSs are private, single-line systems, busy signals are common—especially during peak evening hours. Also, callers are sometimes disappointed to find that the system operator of their favorite BBS has decided to use his or her computer for other purposes. Nevertheless, new systems appear with amazing frequency, and BBS addicts can easily spend as much time on-line as they can afford.

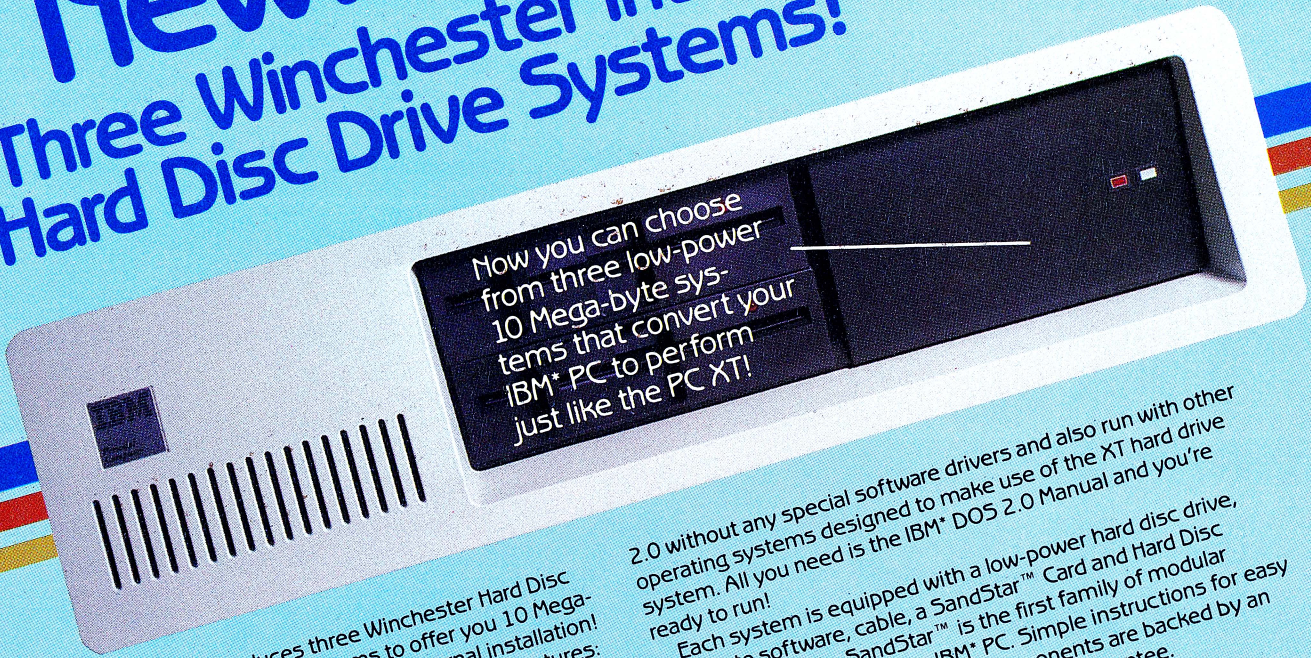
HIGH-TECH GAMING

AS MORE COMPANIES and private individuals develop technologically sophisticated gaming networks, more PC owners will purchase modems in order to explore the new high-tech frontier of game playing. Time and distance will disappear as people separated by thousands of miles meet on-line to negotiate, gamble, share adventures—in short, to do what human beings have done since antiquity: play games. ▲

For more information . . .
CompuServe, (800) 848-8199; (614) 457-8650 in Ohio.
Delphi, (617) 491-3393.
GameMaster, (312) 328-9009 (voice); (312) 475-4884 (modem).
Plato, (800) 233-3784; (800) 233-3785 in California.
The Source, (800) 336-3330; (703) 734-7548 in Virginia.

New!

Three Winchester Internal Hard Disc Drive Systems!



Now you can choose from three low-power 10 Mega-byte systems that convert your IBM* PC to perform just like the PC XT!

Maynard Electronics introduces three Winchester Hard Disc Drive Systems — the only drive systems to offer you 10 Megabytes of formatted capacity with complete internal installation! These systems offer the user countless benefits and features: capability of booting off the hard disc; additional functions while requiring only **one** card slot in your PC; and, use of available power, thereby preventing overheating problems which have affected other drives. Handling heavyweight data was never easier.

All three systems are quality engineered and work with DOS 2.0 without any special software drivers and also run with other operating systems designed to make use of the XT hard drive system. All you need is the IBM* DOS 2.0 Manual and you're ready to run!

Each system is equipped with a low-power hard disc drive, complete software, cable, a SandStar™ Card and Hard Disc Controller Module. SandStar™ is the first family of modular peripherals created for the IBM* PC. Simple instructions for easy installation are included and all components are backed by an Unconditional One Year Parts and Labor Guarantee.

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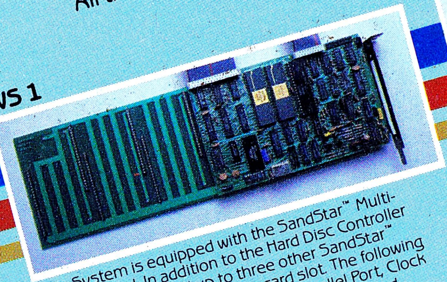
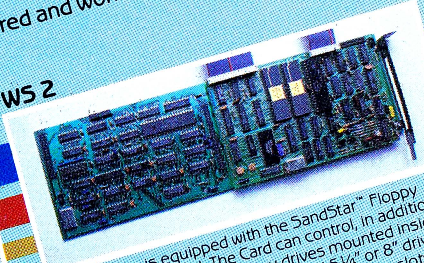


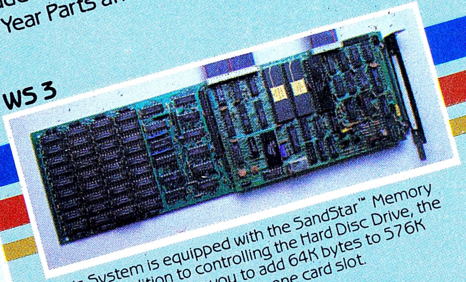
This System is equipped with the SandStar™ Multi-function card. In addition to the Hard Disc Controller Module, you can add up to three other SandStar™ Modules while using only **one** card slot. The following modules are available: Serial Port, Parallel Port, Clock Calendar, Game Adaptor, SASI Host Adaptor and Prototyping Module.

WS 2



This System is equipped with the SandStar™ Floppy Drive Controller Card. The Card can control, in addition to the Hard Disc Drive, two floppy drives mounted inside your PC and optionally two additional 5¼" or 8" drives mounted externally. This leaves three system slots for other expansion boards.

WS 3



This System is equipped with the SandStar™ Memory Card. In addition to controlling the Hard Disc Drive, the Memory Card allows you to add 64K bytes to 576K bytes of memory using only one card slot.

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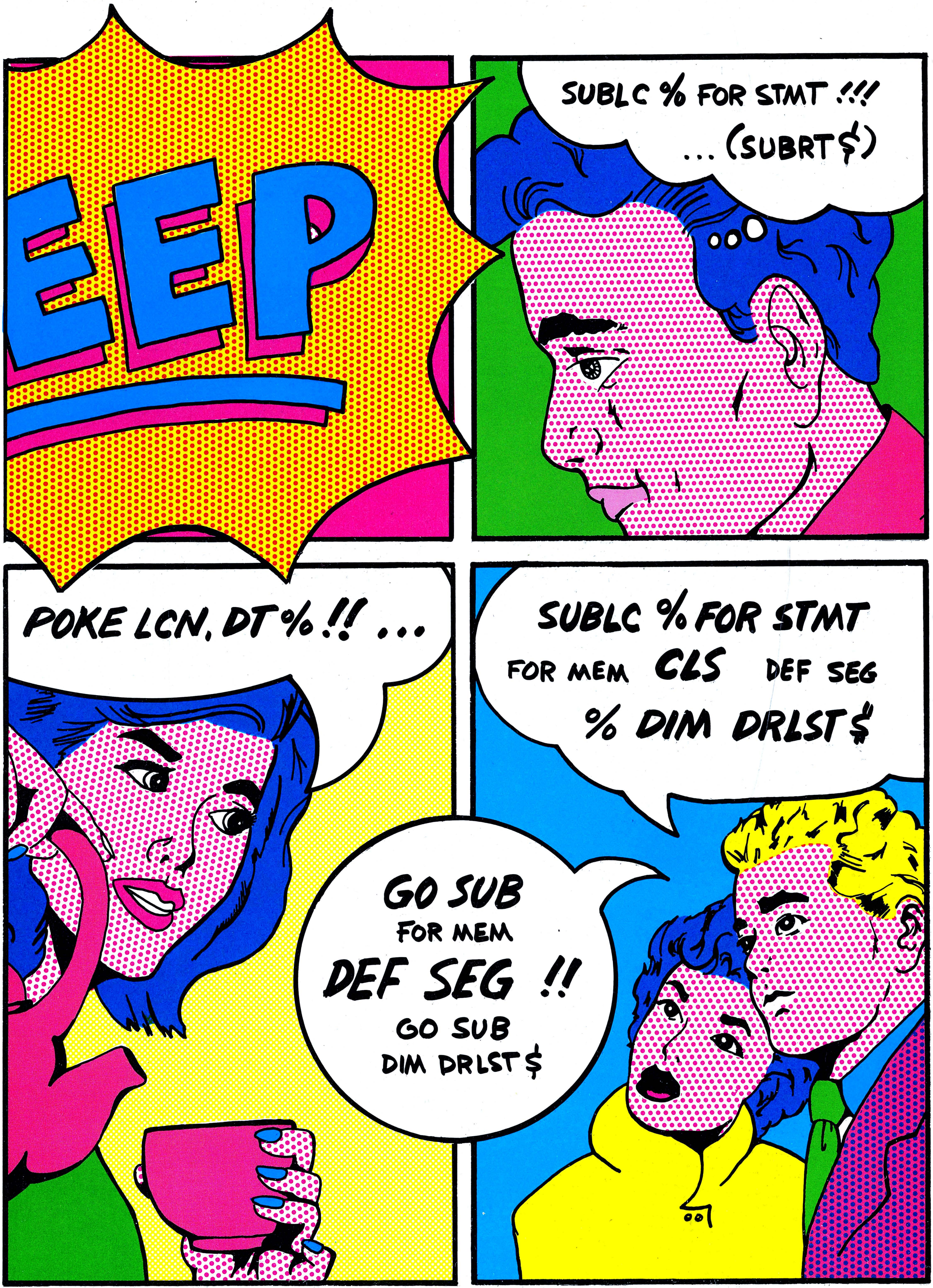
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Illustration by Malcolm Rodgers

COLUMN DEBUT

BASICALLY SPEAKING

BY JOHN DICKINSON

It took a long time for you to get up the gumption, but you finally bought your own computer—and a real IBM at that!

Like a lot of other PC owners, you probably bought your machine for a special purpose. If you're an aspiring writer, for example, you most likely bought a first-rate word processor so you could write that book you've been trying to get going on. Or maybe you bought a home accounting package to help get the family finances in shape and keep the checkbook in balance. If you're a business user, accounting and financial analysis packages may be more your style.

Maybe you've even bought a few more application packages since getting started. Perhaps you have a personal filing system and an electronic desk calendar, or a communications package so you can use home banking services or check up on the Dow Jones News/Retrieval Service.

What's that? You bought some games for the kids too? Great! The *Microsoft Flight Simulator*? For the kids? Oh, well. . . .

In any case, by now you're well into your projects. Your book outline is finally complete, and a few chapters are written; the checkbook still gets out of whack once in a while, but you can blame that on the bank; or maybe you've finally put your payables and receivables in good shape.

Great stuff, all of it—the sort of thing that personal computers like the IBM PC are designed for and do best.

But did you ever wish you could program the thing yourself? Yes, you, program your own PC. Did you ever think about trying it?

No, it's not a silly idea. Thousands of people with little or no background in computers have learned how to program PCs and similar computers, and they've learned easily and in a very short period of time. Yes, at your age.

About twenty years ago two Dartmouth College professors, John Kemeny and Thomas Kurtz, invented a computer language for students to use. They called it BASIC and made it easy to learn so that students could spend their time using a computer to solve problems rather than learning how to program it. And it was a great success; students exposed to BASIC could usually write useful programs after just one lesson.

What could that mean to you? After all, Kemeny and Kurtz had college students in mind when they invented BASIC—youngsters eager to explore the mysteries of computers—not someone like you.

That's true, but it's probably safe to say that BASIC has been learned and used more by people who are not in college than by the students for whom the professors designed it. Many of those people never even saw a college campus.

How did that happen? Very soon after Basic was introduced, it was offered on commercial time-sharing systems by computer companies, and it almost immediately put the power of computers on the nation's desktops. It turned out that the mature business community was just as eager to learn about those computer mysteries as young college students were. By learning how to program in Basic, business people could get their computing done easily and without all the hassles sometimes associated with using the services of data processing departments.

Better yet, Kemeny and Kurtz designed Basic to be a practical language, suitable for solving the same kinds of business and mathematical problems that more advanced languages are designed to handle. It turned out that Basic could be used for more kinds of computer applications than its designers ever dreamed of. Business and scientific users took to Basic like ducks to water.

And so can you. After twenty years, Basic is still very much around. Many attempts have been made to replace it, but none of the alternatives has met with Basic's success. Basic is easily the best-known computer language in the world and is still one of the best languages that anyone of any age can use to learn how to program a computer. And you can easily use Basic to learn how to program your PC.

There's more good news! If you have an IBM PC, an XT, or a PC*jr* (or a Compaq or other PC-compatible computer), you already have some form of Basic—no extra charge. Every IBM PC is delivered with Cassette Basic nestled in its ROM chips, and most PC-compatibles come with Basic supplied on their MS-DOS disks.

But there's no such thing as a free lunch. Basic may come with the machine, but it's not much good if you don't know how to use it.

So, let's learn how to use it.

Yes, right now. Starting this month in *Softalk* you'll learn how to use Basic so that you can write your own programs for your PC. Basic is easy for anyone to learn, and we'll try to make it fun and useful at the same time. So grab a blank disk and join in the fun!

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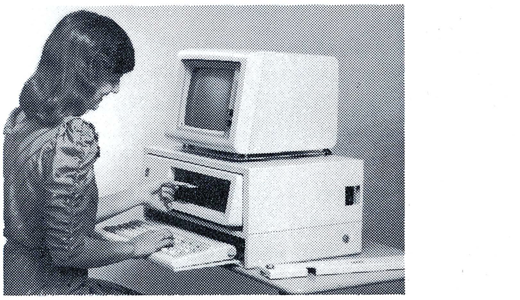

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You probably already have everything you'll need for learning Basic, but let's take a moment to make sure. You'll need an IBM PC of some variety, or a PC-compatible. Either a monochrome or a color display will do; what you learn here will work on either, and we'll even try to make sure that things fit on a forty-character color screen (such as a television set).

It's preferable if your PC has a disk drive, but not absolutely necessary. If you don't have a disk drive, you'll need to have a cassette tape drive attached to your computer if you want to save your programs and use stored data (and you probably will want to). A printer isn't absolutely necessary either, but you'll find it convenient to have one from time to time.

One last thing you'll need is the Basic manual that's supplied by IBM or your PC-compatible vendor. It's a reference manual, not a tutorial for beginners, but we'll refer to it occasionally and you'll probably want it so you can study some things in more detail.

That's all you need. So, if everybody's ready, let's get going. Starting Basic on the PC is no more difficult than starting any other program you've used. The only complication is choosing which version to use. There are several choices, and the choice can be confusing.

On regular IBM PCs there are three options: Cassette Basic, PC-DOS Basic, and Advanced PC-DOS Basic. Cassette Basic is the simplest of the three, PC-DOS Basic incorporates all of Cassette Basic as well as some additional features, and Advanced PC-DOS Basic has all the features of PC-DOS Basic plus a few more. The most important difference between Cassette Basic on the one hand and the two PC-DOS Basics on the other has to do with the method by which programs and data are stored and used. Only the PC-DOS Basics can save programs to disk and use data on disk drives. Cassette Basic is limited to using tape cassettes for programs and data, and it can do that only if you have a tape drive attached to your PC. The PC-DOS Basics can also use a tape drive on regular PCs (but not on XTs).

Two Basics are available for PC*jr*. The machine comes with Cassette Basic, which is just like the Cassette Basic found on regular PCs; Cartridge Basic is optional. You'll need Cartridge Basic if you're going to work with PC-DOS and save programs and data on the Enhanced PC*jr*'s disk. Cartridge Basic does not, however, *require* PC-DOS; it can also use cassette tapes for program and data storage. Cartridge Basic has some other advanced features, in addition to its ability to work with PC-DOS.

Most PC-compatibles come with both MS-DOS Basic and Advanced MS-DOS Basic, which are equivalent to the IBM PC-DOS versions, but some have just one of these. None of the PC-compatibles has Cassette Basic, but some may be able to use a tape drive for saving programs and data.

Let's try to narrow the choices down a bit.

- If you have a regular PC with no disk drives (anybody there?) you have to use Cassette Basic and you must have a tape drive attached in order to save programs and data.
- If you have a regular PC with at least one disk drive, an XT, or a PC-compatible, you should use PC-DOS Basic; you can use Advanced PC-DOS Basic if you wish, but we probably won't use its advanced features in the near future. Either version allows you to use the disk drives—including the Winchester disk on the XT or Compaq Plus as well as most add-on Winchesters—for storing data and programs. You can also use Cassette Basic on IBM PCs that have disk drives (including XTs, even though XTs don't allow you to attach a cassette drive), but it is preferable to use one of the DOS versions.

	Cassette BASIC	Cartridge BASIC	DOS BASIC	Advanced DOS BASIC
PCjr without disk drive	A	A*		
PCjr with disk drive	A	A*		
PC without disk drives	A*			
PC with disk drives	A		A*	A
PC-compatible			A*	A
XT	A		A*	A
XT-compatible			A*	A

NOTE: A = available version; * = recommended version

Table 1. The versions of BASIC available on IBM PC and compatible computers

- If you have a PC*jr* with no disk drives you can use Cassette BASIC, but it may be preferable to use Cartridge BASIC. Either version allows you to save programs and use data on cassette if you have a tape drive attached. If you have an Enhanced PC*jr* with the disk drive you can use Cassette BASIC, but you must use Cartridge BASIC if you want to save programs and data on disks. The PC-DOS BASICs do not work on PC*jr*.

Table 1 summarizes the available and recommended choices for each type of computer. We'll try to present things that will work in all versions of BASIC, especially in the beginning; where there are differences, we'll point them out.

Starting Cassette BASIC on the IBM machines is simple, because it's the version quietly lurking in your PC's ROM chips. Just switch your PC or PC*jr* on, and, after it completes the self-test, BASIC will start automatically. BASIC's soon-to-be-familiar screen (we'll look at it in a moment) will appear on your video display. If you wish to use Cassette BASIC on a PC with disk drives, just start the machine without a PC-DOS disk in the A drive (this will not work on an XT if it is set up to boot PC-DOS or another operating system from the Winchester disk).

Starting Cartridge BASIC on PC*jr* can be done in two ways. One way is to insert Cartridge BASIC in one of the cartridge slots and switch the computer on. Cartridge BASIC will start automatically, just as Cassette BASIC would if the cartridge weren't inserted. The other way is to boot PC-DOS with Cartridge BASIC inserted in a slot, then follow the procedure described later for setting up DOS BASIC.

Getting started with DOS versions of BASIC, or using Cartridge BASIC on PC*jr* with the disk drive, is a little complicated the first time you do it because you have to set things up—much as you had to set things up for your application packages—but it's easy after that. You can ignore the next few paragraphs if you're using Cassette BASIC or Cartridge BASIC without the disk drive, but you might want to refer to them later if you do acquire a disk drive.

Boot up DOS as you normally would, using the original system disk that came with your PC, PC*jr*, or PC-compatible computer. If you're working with a newer version of DOS, you might want to use the most recent system disk you have. If you're using an XT or a Compaq Plus, you can boot DOS from the Winchester disk instead.

Format a new system disk (remember to use the /S option) in the B disk drive (this entire procedure works even if you have only one drive). It doesn't matter whether you make a one- or two-sided disk.

The next step is not necessary if you are using Cartridge BASIC *on a* PCjr. When you've finished formatting the disk, copy the file called BASIC.COM from the DOS disk in the A drive to the new system disk in the B drive (copy BASICA.COM if you wish to use Advanced DOS BASIC).

BASIC.COM is the program that connects the Cassette BASIC in the ROM chips to the PC-DOS operating system on all the IBM PCs. Most PC-compatible computers do not have Cassette BASIC in ROM, so if your machine is a compatible you have to copy an additional file, usually called BASICA.EXE or BASIC.EXE onto your new disk (check your vendor's manuals to make sure of the file's name). This file serves the same function as the Cassette BASIC in the IBM's ROM chips.

If you have an XT, a Compaq Plus, or an equivalent PC-compatible, you may want to make a new DOS 2.0 subdirectory on your Winchester disk just for BASIC. If you do, be sure to copy the files described earlier into the new subdirectory. If you're using an add-on Winchester, follow the disk vendor's procedures for adding programs.

Now you're ready to start DOS BASIC. Insert your new system disk into the A drive (or change directories on your Winchester disk) and type:

```
A>BASIC
```

Or, if you're using Advanced DOS BASIC, type:

```
A>BASICA
```

Either command will work to start Cartridge BASIC on a PC*jr* if you're

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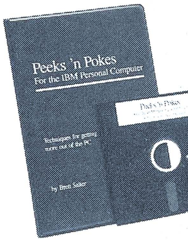

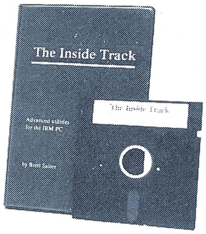

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using it with PC-DOS. Basic's screen will appear on your video display. This will happen quite rapidly on the IBM machines (almost instantly on PC*jr*) and a little more slowly on PC-compatibles.

Believe it or not, you're just about set to start programming in Basic. You folks running Cassette or Cartridge Basic are still paying attention, aren't you?

Let's take a moment to look at Basic's screen—the screen that comes up when you first enter Basic. This screen represents your working environment for using Basic, so you should understand what's displayed on it and what it means. We'll get started now and learn more about it as we go along.

Information about the version of Basic you're using and about your computer (as seen by Basic) appears at the top of the screen. It looks like this:

```
The IBM Personal Computer Basic
Version VX.XX Copyright IBM Corp. 1981, 1982, 1983
XXXXX Bytes free
Ok
```

The version number displayed identifies the version of Basic you are using. Here's what the letter before the version number means:

C	**Cassette**
J	**Cartridge**
D	**DOS**
A	**Advanced DOS**

PC*jr*'s display will say "The IBM PC jr. Basic" on the first line. The "X.XX" will be a number such as 1.10 or 2.00, depending on which PC you have and the version of PC-DOS (or Basic Cartridge) you are using. It will always be 1.02 for Cassette Basic.

On PC-compatibles the version display at the top of the screen is slightly different. The Compaq, for example, displays the following:

```
The COMPAQ Personal Computer Basic
Version X.XX
(C) Copyright COMPAQ Computer Corp. 1982, 1983
(C) Copyright Microsoft 1982, 1983
XXXXX Bytes free
Ok
```

The version number displayed on PC-compatibles depends on the version of MS-DOS you're using.

The "XXXXX Bytes free" message tells you how much room you and Basic can use in your computer. Both your Basic programs and the data they use take up memory, and this message indicates the amount of memory available for storing them. The exact amount you have depends on the type of computer you're using, how much memory is installed, and the version of Basic you're running. The maximum amount of memory that Basic can use on a PC or a PC-compatible is slightly more than sixty thousand bytes; the minimum is about forty thousand bytes.

The bottom line of your display shows you which Basic commands the PC's function keys can be used for. If you're using an eighty-character screen, the definitions of all ten keys will be displayed, but only the first five will be displayed on a forty-character screen. We won't use the function keys for a while, so you can ignore them for the moment.

The "Ok" below the version display means that Basic is ready to accept commands. Are you ready to issue them?

Issuing Basic commands is very much like using DOS. You type the desired command and then press the enter key to execute the command. The enter key is Basic's *go* button—the one that makes things happen. One difference between Basic and DOS is that Basic allows you to enter commands anywhere on the open area of the screen (this should be a familiar idea to you, especially if you've used a word processor) and to use the cursor keys to position things wherever you want them. In most cases you can even insert spaces into commands wherever you want to. For the moment, however, you should try to type things into Basic's screen exactly as you see them here.

Type the following command into Basic's screen:

```
Ok?
? y [Enter]
```

A 0 should appear below the *? y* command immediately after you press the enter key, like this:

```
Ok?
? y [Enter]
0
Ok
```

Basic will issue an error message if you make a typing mistake. For example, if you type:

```
Ok
y [Enter]
```

Basic will display:

```
Ok
y [Enter]
Syntax error
Ok
```

on your screen. Basic's error messages are accurate—this one means that Basic just doesn't understand what you typed—although somewhat cryptic, and there are quite a few of them. Only some, like "Syntax error," appear frequently—they usually show up in response to

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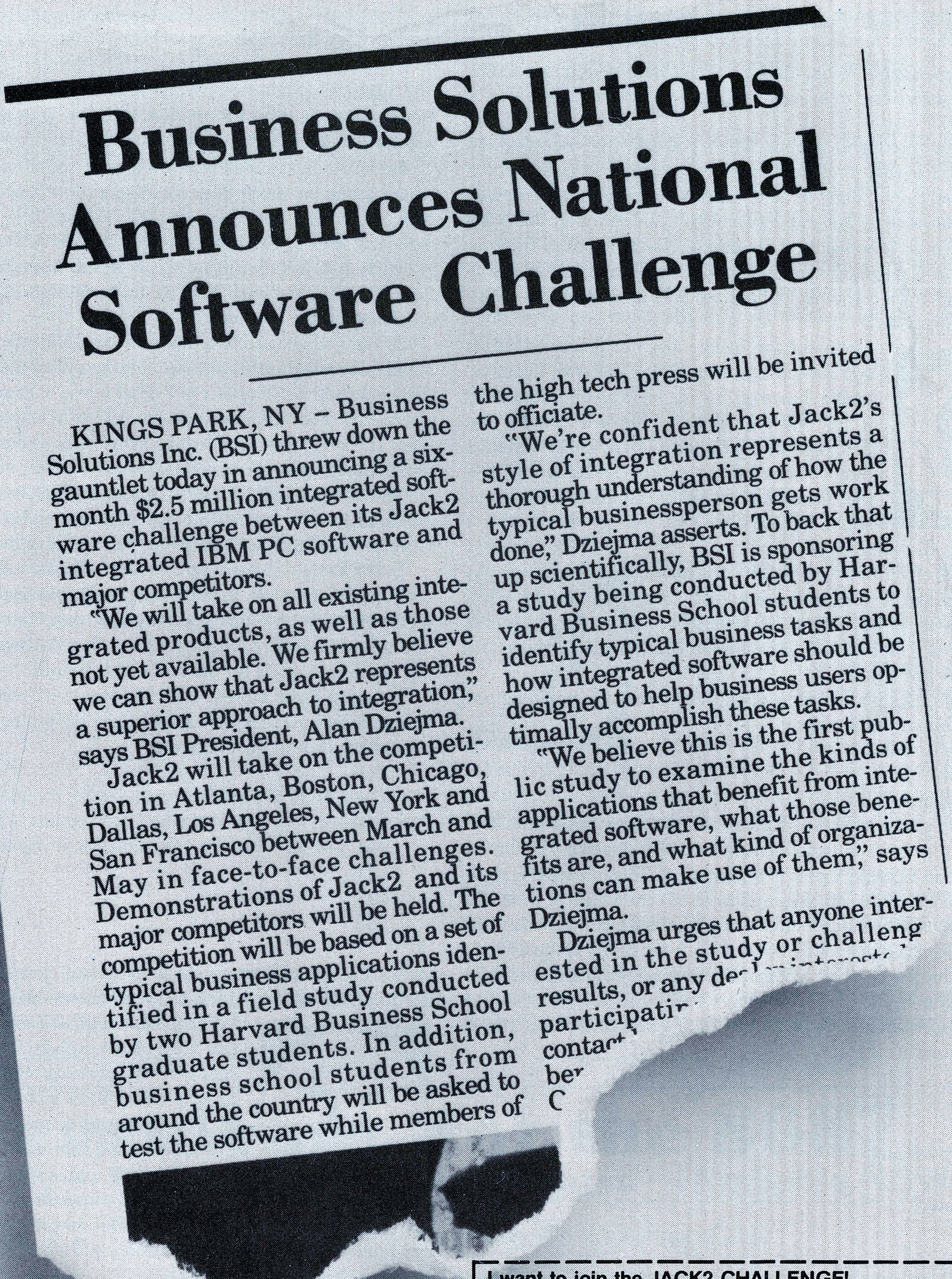

Business Solutions Announces National Software Challenge

KINGS PARK, NY – Business Solutions Inc. (BSI) threw down the gauntlet today in announcing a six-month $2.5 million integrated software challenge between its Jack2 integrated IBM PC software and major competitors.

"We will take on all existing integrated products, as well as those not yet available. We firmly believe we can show that Jack2 represents a superior approach to integration," says BSI President, Alan Dziejma.

Jack2 will take on the competition in Atlanta, Boston, Chicago, Dallas, Los Angeles, New York and San Francisco between March and May in face-to-face challenges. Demonstrations of Jack2 and its major competitors will be held. The competition will be based on a set of typical business applications identified in a field study conducted by two Harvard Business School graduate students. In addition, business school students from around the country will be asked to test the software while members of the high tech press will be invited to officiate.

"We're confident that Jack2's style of integration represents a thorough understanding of how the typical businessperson gets work done," Dziejma asserts. To back that up scientifically, BSI is sponsoring a study being conducted by Harvard Business School students to identify typical business tasks and how integrated software should be designed to help business users optimally accomplish these tasks.

"We believe this is the first public study to examine the kinds of applications that benefit from integrated software, what those benefits are, and what kind of organizations can make use of them," says Dziejma.

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typing errors—and we'll cover them when it seems most appropriate to do so.

Back to our example. What did we do, and what does it mean? The command *? y* asks Basic to answer the question, "What is the value of the variable *y*?"

This is like a question in algebra, where you ask what the value of a variable is. A variable in algebra is the name given to an unknown quantity. There are two ways to determine a variable's value. One way is to *assume* its value by assigning it some constant number. The other way is to determine its value by evaluating a statement, called an equation; the equation assigns the variable a value by defining a relationship between it and other variables (whose value is known or can be assumed) and constants.

Basic works a lot like algebra; it uses variables and constants in almost the same way. In our example, however, we made no assumption about *y*, nor did we define *y* with a statement that described its relationship to any other variables or constants. What we did, in other words, was more or less like opening an algebra book and seeing the question

What is the value of y?

on the first page. Without any other information, we'd have to make our own judgment or assumption about the value of *y*; and this is just what Basic does. In the absence of other information, Basic assumes that the value of a variable is 0. So, when we asked Basic the value of *y*, the answer we got was 0.

When you pick up an algebra book, it's more likely you'll be presented with this sort of problem:

Let y = x + 8
Let x = 7
What is the value of y?

To determine *y*'s value we need an algebraic statement that defines it. In this case, *Let y = x + 8* is that statement, and it tells us that *y* is equal to the value of the variable *x* plus the constant 8. To evaluate this statement, we need to make an assumption about the value of *x*. In this example we're told to assume that *x* is equal to the constant 7. Once that assumption has been made, we can easily see that *y* is equal to 15.

We can solve this algebra problem in our heads, but can Basic solve it? Let's find out.

Type the problem into Basic as a series of Basic commands, just as it appears above:

```
Ok
let y = x + 8 [Enter]
Ok
let x = 7 [Enter]
Ok
? y [Enter]
8
Ok
```

Oops! Something must be wrong. If we can do a problem in our heads, Basic ought to be able to do it!

What's wrong is that, while we presented the problem to Basic in a logical order, we have to follow a stricter order if Basic is to do its job:

First, we have to tell Basic our assumption about *x*.

Second, we have to tell Basic what the relationship between *y* and *x* is and ask it to figure out the value of *y*.

Third, we can ask Basic to tell us the value of *y*.

The following sequence of Basic commands should put things in the correct order and give us the right answer:

```
Ok
let x = 7 [Enter]
Ok
let y = x + 8 [Enter]
Ok
? y [Enter]
15
Ok
```

Hooray—we've solved a problem in Basic! Not much of a problem, was it?

But let's look at it for a moment longer, just to be sure we understand what's going on. Each Basic command you type in—every line you type, up to the point where you hit the enter key—represents a Basic statement. Every assumption, every variable definition, and even every question is, as far as Basic is concerned, a program statement. Each time you press the enter key, Basic executes (acts on the instructions contained in) the statement.

So far, you've used two kinds of Basic statements. Basic's *let* command is for assumptions and definitions, and all of the Basic statements that begin with *let* (like *let x = 7* or *let y = x + 8*) are called *assignment* statements. They are used to assign values or definitions to Basic variables. The symbol = is called the *assignment operator* when it appears in a Basic assignment statement.

The *?* command asks Basic about the value of a variable. Statements such as *? y* are called *output* statements, because they ask Basic to output results of its calculations performed onto our video displays.

Every Basic statement you've learned so far uses what is called Basic's *immediate mode*. In immediate mode, commands are executed immediately each time you press the enter key. Next month, we'll learn about Basic's *deferred mode* for executing statements, but we'll be using immediate mode for the rest of this month.

Let's give Basic more to do ("Ok" means it's ready to do more), and this time, let's make it more interesting. Try typing the following series of commands into Basic's screen:

```
Ok
let x = 10
Ok
let y = 32 + (x * 9 / 5)
Ok
? y
50
Ok
```

Now, that's more like a computer problem—something we can't as easily do in our heads! And there are some new things to notice.

This problem contains a couple of new symbols that we'd better explain. These are some of Basic's symbols for doing mathematical operations (they're called Basic math operators), and they may be a little different from what you're used to. Addition and subtraction in Basic use the familiar plus and minus signs, but multiplication, division, and exponentiation use symbols that are unique to computer languages. Our new example uses the symbols for multiplication (*) and division (/). Here's a list of Basic's major mathematical operators:

+ **Addition**
− **Subtraction**
* **Multiplication**
/ **Division**
∧ **Exponentiation (∧ is shift-6)**

There are a couple more Basic mathematical operators, but we'll cover them later on when we need them.

You can use Basic's operators with variables and constants, much as you'd use algebraic operators. The statement that defines *y* in our example includes a constant (32) that is added to a product. The product is computed by multiplying the variable *x* by a ratio. The ratio is computed by dividing one constant (9) by another (5). Basic takes all this mixing of variables, constants, and operators in stride.

Notice that, once again, we first stated our assumptions about *x* by means of an assignment statement; then we used another assignment statement to define *y*'s relationship to *x* and to the constants. Only after all that was done did we finally issue an output statement asking Basic to display the value of *y*.

We've stopped reminding you to use the enter key for each line—that should be getting to be a habit by now. From here on, we'll also be leaving out the "Ok" every time you can expect Basic to display it on your screen.

Basic can do a calculation and display the results at the same time. For example, if you want to know what the ratio of 9/5 is, type the following into Basic's screen:

```
? 9 / 5
1.8
```

Any variable's current value can be displayed. Just ask Basic to do it. Try this:

```
? x
10
```

Basic remembers the current value of variables because it stores them in your computer's memory. Constants never need to be stored; they're mathematical facts of life to Basic, just as they are to you. But Basic needs to store the value of a variable in memory so that it can use that variable in subsequent calculations you may want it to perform.

You can continue asking Basic to display *y*, or any other variable you wish, for as long as your computer is switched on (or until you leave Basic). Just type:

```
? y
50
```

or

```
? x
10
```

Variables can change in value—they are variable, after all—whenever you want them to change. You'll be learning several ways to do it. The easiest way is simply to reassign the variables, like this:

```
let x = 17
let y = 22
? x,y
17        22
```

What's that comma about? Basic can display more than one variable at one time. In this case we've asked it to display both *x* and *y*. To get it to display more than one variable at a time, all we need to do is separate the variables with commas. Why is the comma necessary? If we didn't use something to separate the variables, Basic would assume we'd asked it to display some other variable. For example, if we typed:

```
?xy
0
```

Basic would assume that we'd asked it to display the value of a new variable named *xy* and, of course, would assume this new variable's value to be 0. Basic's language rules require that we use a comma as a separator, or *delimiter*, to separate items in an output statement.

Until now we've been using *x* and *y* as variable names, but you might have gotten the hint in the last paragraph that Basic variable names can be more flexible and creative than that. In fact, we can name variables pretty much anything we want as long as we follow three simple rules:

- Variable names must always start with an alphabetic character (a through z).
- Variable names may not be more than forty characters in length.
- Variable names must contain only alphabetic or numeric characters, or the character ".".

As you'll see in a moment, these rules are easy to live with and allow you to use names that have real meaning to the problem you're trying to solve with Basic.

First, however, your PC's screen must be quite a mess by now, so let's sweep it off. Some Basic commands have nothing to do with variables or arithmetic of any kind. They just do something that helps Basic's operating environment. Here's one that you'll come to appreciate:

```
cls
```

Bet you wish you had one of those for your desk or the living room floor! The command *cls* is a convenient abbreviation that means *clear the screen*; you can use it any time you want to have a fresh working surface. It doesn't alter the value of any variables, however. When you want to do that, type:

```
clear
```

The *clear* command says to Basic, "Clear out your memory." That, of course, means reinitialize (that is, reset to 0) the values of all variables.

Now that that's out of the way, does anyone recognize the real meaning of the formula we were working with a few minutes ago? It's a formula that every weather forecaster wishes you'd remember. Let's retype our Basic program using variable names that describe the prob-

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lem, and using our ability to display two variables. Then you'll recognize its meaning:

```
let temp.Celsius = 10
let temp.Fahrenheit = 32 + (temp.Celsius * 9 / 5)
? temp.Fahrenheit, temp.Celsius
50        10
```

This time we're using variable names that describe the problem, and it is now obvious that we're converting temperatures from the Celsius scale to the Fahrenheit scale. It makes no difference to BASIC what you call your variables, but it will make a difference to you as you progress to writing longer and more meaty BASIC programs.

It's handy to be able to convert temperatures quickly from one scale to the other, and it's certainly easier to do it in BASIC than it would be with your pocket calculator. At this level of complexity, that's largely because the computer lets you "write" everything down on your screen as you work. But computers offer other advantages as well. One of the things they do best is repeat themselves, and you will want to use this ability quite a bit as you learn to program in BASIC.

Why is repetition useful? Suppose we wanted to know the Fahrenheit temperature for every Celsius temperature from 10 to 100 degrees at ten-degree steps. One way to determine these temperatures would be to keep retyping the previous sequence using different values for temp.Celsius. But it's easier to let your PC do the work by repeating itself. So let's look now at a crude but effective way to make BASIC repeat itself. We'll also see another way to modify BASIC variables.

We can change the value of a BASIC variable by adding to, subtracting from, or otherwise modifying its current value. For example, to increase a Celsius temperature by ten degrees, type the following right below the "Ok" on your screen:

```
let temp.Celsius = temp.Celsius + 10
```

You probably would have flunked algebra for that one! A statement like this one doesn't make any sense in algebra, because algebra doesn't have your PC's memory working for it. Remember, we said that the = sign is used as an assignment operator in BASIC assignment (*let*) statements, and here we're just assigning temp.Celsius's value to be whatever it currently is (10) plus ten; we're altering the contents of that chunk of computer memory where BASIC happens to be storing the current value of temp.Celsius.

The result should be that temp.Celsius's value is now 20. To find out if this is so, type:

```
? temp.Celsius
 20
```

Good! BASIC has increased the value of temp.Celsius by 10, just as requested.

Now we want to make BASIC repeat itself and then recompute temp.Fahrenheit using the new value, 20, for temp.Celsius. To do that, BASIC has to repeat the entire sequence of statements, starting with:

```
let temp.Fahrenheit = 32 + (temp.Celsius * 9 / 5)
```

BASIC's flexible screen environment makes it easy for us to do this. Start by pressing the up-arrow key (on the numeric keypad) ten times. Remember, the cursor keys can be used to put the cursor wherever we want on BASIC's screen, and this time we want it to be right on the same line as the *let* statement that defines our conversion formula.

Once the cursor is on that line, press the enter key. Pressing the enter key at this point causes BASIC to reread the *let* statement on which the cursor is positioned and recompute temp.Fahrenheit (remember, the enter key is BASIC's *go* button). This time, however, BASIC uses the new value for temp.Celsius, 20, when it calculates temp.Fahrenheit. After you press the enter key the cursor will be positioned on this line:

```
? temp.Fahrenheit, temp.Celsius
```

just as it was the first time we did this. After all, we're repeating things here. We can get BASIC to display our new results by pressing the enter key once again. This time the enter key causes BASIC to reread and reexecute the output statement and to display

```
68 20
```

on your screen.

By moving the cursor up the screen and back down again, you've had BASIC recalculate and redisplay the formula using the increased value of temp.Celsius. It's important to notice that you *must* use the enter key in order for this to work. The down-arrow key will move the cursor down, just as the enter key does, but it will not have the effect on BASIC that the enter key has. BASIC simply won't take any action unless you press the enter key.

So far, you've increased temp.Celsius's value to 20 and repeated the calculation. To complete the problem we set before ourselves—the conversion to Fahrenheit of all Celsius values from 10 to 100 at ten-degree steps—we have to increase the value of temp.Celsius eight more times to make it 100 and have BASIC repeat the entire calculation each time.

Just to make sure we know what we're doing, let's go over what we should do. Your cursor should now be on the line that says:

```
let temp.Celsius = temp.Celsius + 10
```

That's the first thing we have to get BASIC to repeat. So do the following steps eight more times:

1. Press the enter key to increase the value of temp.Celsius by 10.
2. Press the enter key to display the value of temp.Celsius.
3. Press the up-arrow key ten times, until the cursor is on the same line as the statement

```
let temp.Fahrenheit = 32 + (temp.Celsius * 9 / 5)
```

4. Press the enter key to recalculate the formula.
5. Press the enter key to display the new results.
6. Return to step 1.

When you've done all of this seven more times you should finally see:

```
? temp.Fahrenheit, temp.Celsius
212       100
```

on your screen. You can keep increasing the Celsius temperature if you want to, but it might be more interesting to see if you can decrease it. There are easier ways to make BASIC repeat itself, but we'll have to hold off on that subject until a later issue.

By now you're probably wondering how to get out of BASIC. If you're using Cassette BASIC or Cartridge BASIC without PC-DOS, you have to reboot your system (with a PC-DOS disk inserted if you're equipped for it) or just switch the computer off. If you're using one of the DOS BASICS, or Cartridge BASIC with PC-DOS, you can just type:

```
system
```

and you'll return to DOS.

Well, you've come quite a distance from thinking that programming your own PC was a silly idea. You've already learned about BASIC's use of variables and constants and how to work with them in assignment and output statements. You've started to learn about BASIC *housekeeping* commands, including *cls* and *clear*, and how to use BASIC's screen as both an input and a programming mechanism.

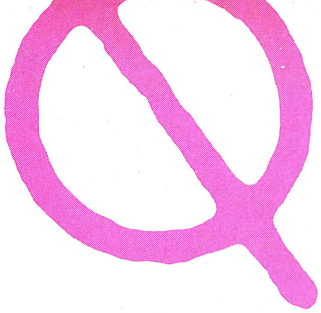
You shouldn't have any trouble starting BASIC up from now on; if you're using one of the DOS versions, carefully label your disk so that you don't accidentally save something else on it.

But don't just put BASIC aside until we meet again. Experiment. Try using BASIC as a calculator. Just use assignment and output statements that duplicate problems you solve on your handheld model.

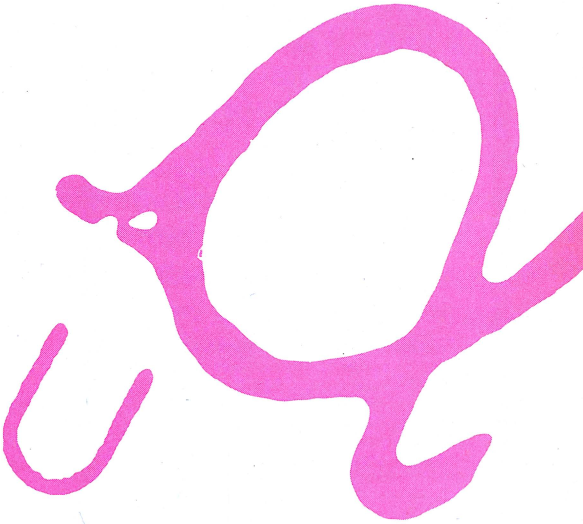
Or see if you can figure out how to reverse our last problem and calculate Celsius temperatures when you know their Fahrenheit equivalents. Believe it or not, this won't be simple; you'll most likely run into a problem that next month's column will help you straighten out. Next month you'll also learn how to save your programs for later use.

See you then. ▲

A Pretty strange-looking Language



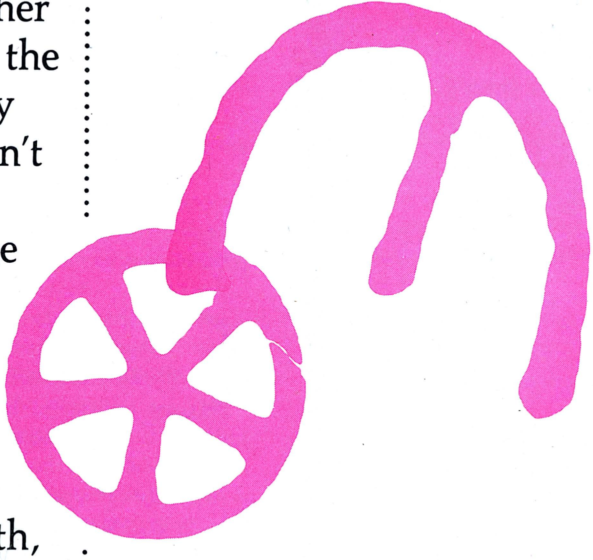
A Review of Two APL Systems



by Bruce Filbeck

This article should probably have been called "What?! APL??" because that's the reaction most people have if you suggest that they might want to program in this language. Some even respond with "What *is* APL?"

If your response to APL is like either of these, read on. Before you get to the end of this article, your feelings may change (then again, maybe they won't … but read on, anyway!).



Let's look first at the APL language in general. We'll follow that with a review of two APL systems—one from IBM and one from Watsoft.

APL stands for *A P*rogramming *L*anguage. The name tells you more than you might realize. To begin with, it's not a particularly descriptive name—and APL isn't a particularly descriptive language. Some people find it a little cryptic, in fact. Probably the only statements in an APL program

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that the uninitiated will recognize are the comments.

The name also indicates that this language has no well-defined purpose. It wasn't designed specifically for *For*mula *Tran*slation, and it's certainly not a *Co*mmon *B*usiness-*O*riented *L*anguage.

And, of course, the name suggests that APL is for programming. APL can pack more programming into a line of code than you ever thought was possible.

Although APL was designed to be a general-purpose language and although it's used for many kinds of applications, number crunching is where it really shines. Number crunching means applications that require complex calculations involving large arrays of numbers or other mathematical computations.

Even if you don't giggle at the thought of matrix algebra, however, APL might still be for you. Several points can be made both for and against the language. Let's consider some.

First, for any computer program to run, it must be in the only language that the computer understands—machine language. Therefore, any program you write must be converted to machine language before the computer can understand it. The two major methods of doing this are *compiling* and *interpreting* (the latter is sometimes called *translating*).

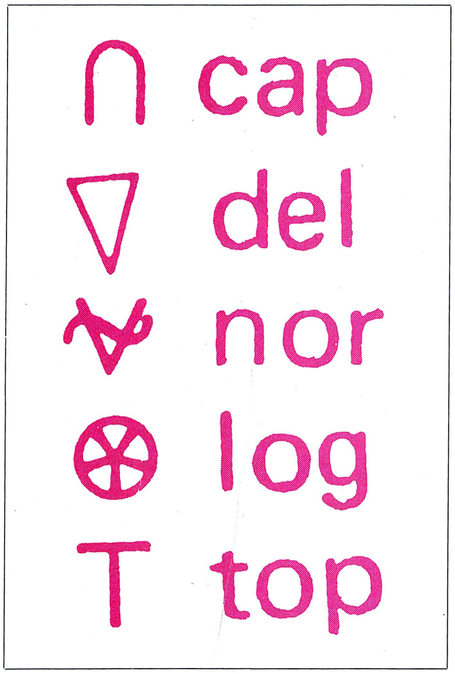
A compiler takes your *source* program (the program as you have written it) and turns it into machine language. It stores the machine language version (called the *object* program) in a disk file so that you can run it whenever you want. An interpreter, on the other hand, converts your source program to machine language only at the time you run the program. And it must retranslate it *every* time you run it.

Compiled languages have definite advantages over interpreted languages. A compiled program runs faster than an equivalent program that must be translated at runtime—because the translation is already done. But of course the coin has another side, or interpreters wouldn't exist.

If you're working with a language that's interpreted, it's easy to write a small portion of a program and then run it to see how it works—without going through the whole compilation process. And you can continue to modify and optimize your program, checking it out along the way. You can work in this fashion with a compiled language too, of course, but it's clumsier.

Because APL is an interpreted language, it doesn't require you to write a complete program, compile it, then run it before you can find out that your logic is faulty. You can discover your mistakes right away. Fixing program bugs one at a time is much easier than trying to solve a whole program's worth at once.

APL does not use *strong data typing* (that may be the understatement of the month). This means that you don't have to define variables before you use them within a program and that you don't have to identify the kind of information that will be contained in each variable. For example, if you want to assign the current temperature to a variable, you just write an assignment statement and the deed is done.



You don't even have to append a symbol to the variable name indicating what kind of data the variable will hold (as you do, for example, in Basic). Although this freedom won't do much to encourage your development as a writer of structured programs, it does make your programming a lot easier.

APL programs (called *defined functions*) usually run quite fast, considering the fact that APL is interpreted. The speed of the language can be attributed to the fact that these defined functions are generally quite short. APL commands (called *primitive functions* and *operators*) are very powerful. Experienced APL programmers seem to delight in cramming as much programming as possible into each line of code.

This high-density approach is often carried to extremes and has nothing to recommend it; it should be avoided particularly by those who are new to the language. APL can (and probably should) be written one simple statement at a time. Working that way makes finding syntax errors much easier. And if you follow this recommendation, you'll find APL easy to learn and fun to use.

The most confusing aspect of the language is probably its use of symbols as operators. In addition to familiar mathematical operators, like + and −, APL uses a lot of symbols that you may never have seen before. These tend to make APL programs look like hieroglyphics. The confusion this may engender will be temporary, however; you'll find yourself using caps, alphas, stiles, and other glyphs before you know it.

APL, like Basic, can be used in direct mode. In other words, you can type in a simple statement, like *2 + 2*, followed by a return, and APL will print an answer for you on the next line. It's not even necessary to include the *print* command that Basic would require.

In APL, as in Basic, you can also assign values to variables in direct mode and then perform operations on the variables. In this manner, it's possible to use the primitive functions and operators by themselves and determine exactly how each one works. An understanding of this feature, along with a good tutorial book, is enough to get most learners started with the language.

APL has some significant disadvantages. Because it's written primarily with symbols, it requires some special symbol-generating hardware. This means, unfortunately, that programs written in APL are not easily transported from one kind of computer to another. Because hardware costs money, it also means extra expense.

Most of the symbols used by APL are not included in IBM's ASCII set. So to use the language, you need to install a ROM with the APL character set or you need software that will generate the special characters in graphics mode. In either case, you need a graphics printer if you want to print your programs.

The only computer systems that will run your APL programs are those equipped with a compatible APL programming system. And, unfortunately, APL isn't exactly in widespread use on personal computers (yet), so you're a little limited in terms of the machines that can run your programs. You'll also have to write any APL programs you need yourself, since commercial APL software is scarce.

Notwithstanding these disadvantages, several companies are marketing APL programming systems for the PC. The most prominent provider is IBM. The IBM Personal Computer APL system retails for $195 and requires 128K, a color/graphics adapter, and an 8087 math coprocessor chip (see "The Analytical Engine," p. 112). Included with the APL program disk is a set of transparent decals that depict the APL characters in red. These decals can be placed on the appropriate keys to show which key generates which character.

IBM's APL includes all the standard primitive functions and operators, as well as some additional implementations and extensions. Among the more significant additions are auxiliary processors—programs that carry out special actions not included in the APL language. These programs deal with such things as graphics printer control, BIOS/DOS interrupt handling, full-screen display management, file management, asynchronous communications control, and music generation. If you want to use any of these auxiliary processors during a session, you must say so when you bring up the APL system; none of the auxiliary processors can be loaded once you've started working.

As you know if you're familiar with the language, APL operates by using a *workspace* as the common organizational unit. A workspace is an area of memory that contains all the primitive functions, defined functions (programs), variables, and so forth that are generated and used during a computation.

IBM's implementation of APL divides the workspace into two parts: the *main workspace* and the *elastic workspace*. The former, which is where all APL statements are executed and all APL objects are created and modified, is limited to 64K. The elastic workspace can use all additional free memory. APL objects not currently in use are automatically transferred to the elastic workspace if additional memory is needed for an operation in the main workspace. This approach provides some benefits over a workspace of fixed size, but the main workspace is still limited to 64K.

The APL disk contains several workspaces of defined functions that can be used as examples of how to program with the auxiliary processors. They include *print*, *edit*, *file*, *VM232*, and *music*. The functions included in these workspaces tend to simplify some of the more complex operations, such as communications and working with DOS files.

IBM's manual, which is definitely not a tutorial, is in two sections—an operations guide and a reference. The operations section describes how to load and operate the software; the reference provides a

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detailed description—with examples—of each of the primitive functions and operators. The documentation is good overall, assuming you already know APL; but it's not everything a beginner will need.

The IBM Personal Computer APL system is a good general-purpose implementation of the language; it has all the features you'd expect from IBM—at a reasonable price. The extensive hardware requirements are probably the biggest drawback to the package.

A different approach is taken in Watcom APL v2.0, from Watsoft Products (158 University Avenue West, Waterloo, Ontario, Canada N2L 3E9). Priced at $450, this APL system, which requires 192K and works with either the monochrome or the graphics display, is the improved version of what used to be called Waterloo Micro APL v1.2. According to its documentation, this version is *so* new and improved that workspaces and sequential files of APL arrays created under the earlier version are incompatible with the current system (instructions are provided, however, for converting these items to run under version 2.0).

In addition to the program disk, the package includes a disk that contains sample workspaces, a character-generator ROM chip for the display board, a reference card, a reference manual, a user guide, a set of keytop stickers, and a thirteen-page set of "read me first" instructions. These instructions describe in detail the steps required to install the ROM, should you choose to do that yourself (Watsoft recommends that you don't do it yourself if you've never installed a chip before).

Once the ROM is installed, you can see the appropriate APL symbols on your display. These symbols replace the foreign and mathematical symbols that on the IBM PC are ordinarily associated with ASCII values 128 through 175 and 225 through 253. For most PC owners, these characters are the least used of the entire extended ASCII set, so their replacement by the APL character set isn't likely to interfere with normal operations.

The big advantage of Watsoft's character set over IBM's is that it can use either display adapter. Thus, if you have the IBM monochrome adapter, you're spared the expense of getting a graphics card (and monitor) and you can enjoy the high resolution of the IBM monochrome display—a distinct advantage because of the APL characters' visual complexity.

The Watsoft documentation is professional in both appearance and content. All three manuals are spiral-bound and therefore lie open next to your computer. The user guide is a tutorial designed for use with the reference manual. It begins with a section called "Getting Started with DOS," which directs you to your IBM DOS manual. Later it leads you into the more complex areas of APL. With the investment of a little time, the user can progress from neophyte to accomplished APL programmer using only the supplied documentation.

Watcom APL includes all the standard APL functions and operators, as well as several enhancements. If your PC has an 8087 installed, this APL will make full use of it. However, the software will operate even if you don't have an 8087.

You're allowed to set the contents of your function keys in all their shift states (normal, shift, control, and alt); the one limitation on function-key settings is that the total length of the strings assigned to function keys cannot exceed 200 characters. Several other system functions are supported, including *quad peek* and *quad poke*, which are similar to Basic's *peek* and *poke* statements.

Full use is made of all available memory, but, as mentioned before, you have to have at least 192K; more memory is helpful, since the APL interpreter itself is more than 123,000 bytes long and other options can be loaded along with it. This large memory requirement is the major drawback to this programming system.

Included with Watcom APL is a full-screen editor with a lot of facilities to simplify text entry. APL allows you to enter programs by going into a "function definition" mode (similar to automatic numbering in Basic); this eliminates the need for a full-screen editor, but Watsoft chose to include one anyway. You'll find it useful. Like the rest of the programs in this package, it's well written and clearly documented.

APL has a devoted group of followers who sing its praises to all who'll listen. These devotees seem to consider any other language a poor substitute. If you'd like to see what the enthusiasm is about, consider taking the time to learn the fundamentals of APL. Both the packages discussed here will give you all the software necessary not only to "get your feet wet" but also to keep you programming in APL for a long time. ▲

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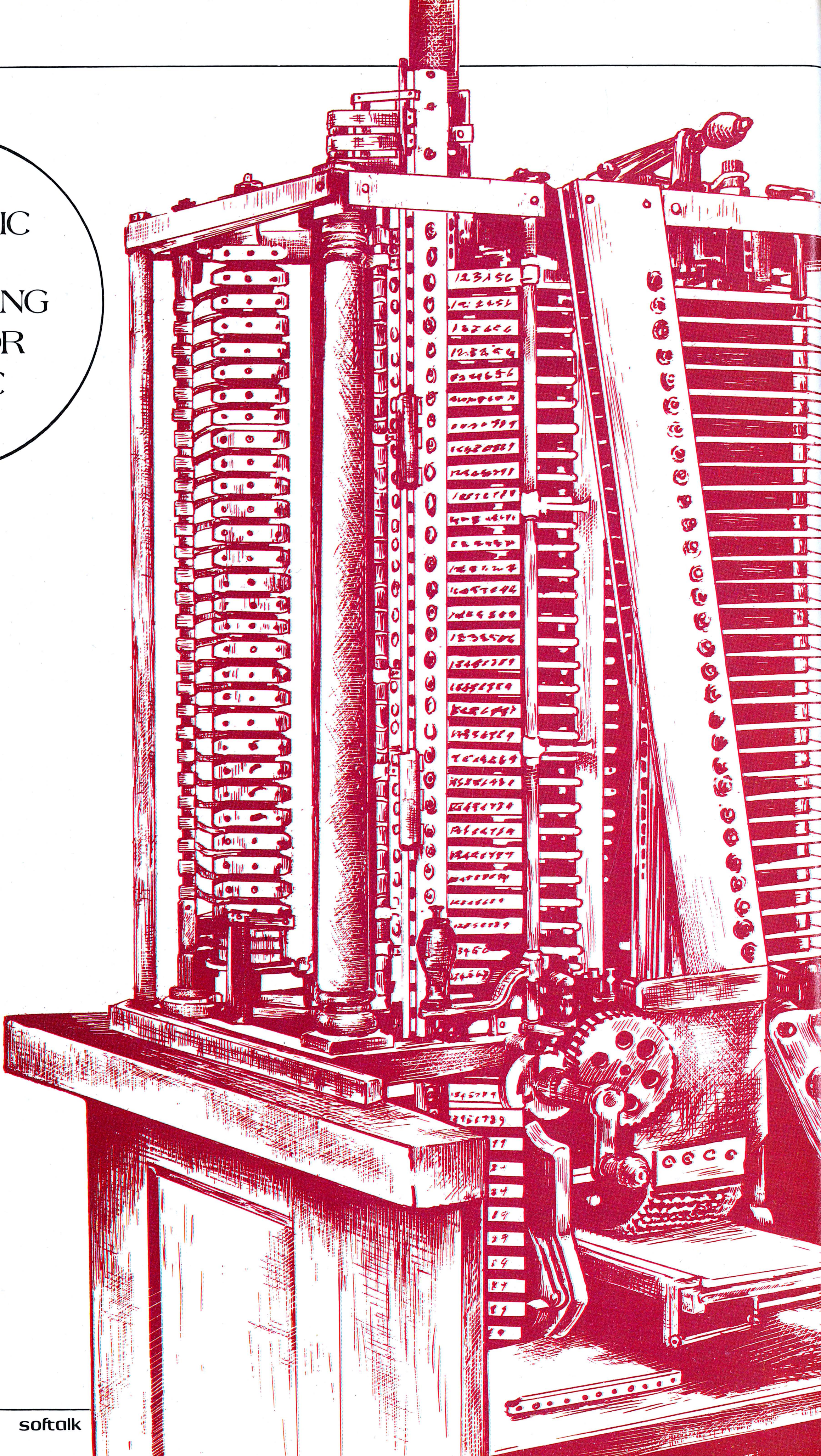

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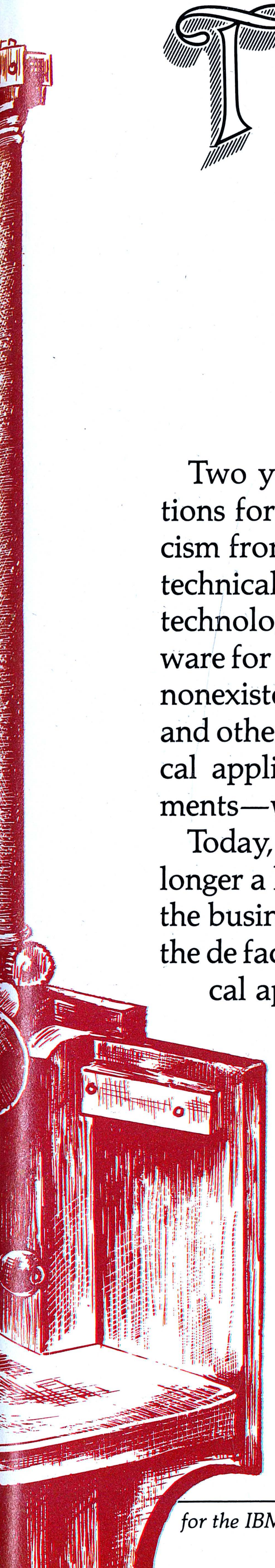

Two years ago, a series of articles about scientific and engineering applications for the PC probably would have been greeted with considerable skepticism from potential readers. When the PC was introduced, the reaction in the technical community was, at best, a large yawn. The machine was viewed as technologically conventional and unexciting. Moreover, hardware and software for applications such as data acquisition and large-scale computation were nonexistent. At that time, microcomputers made by DEC, Hewlett-Packard, and other companies were much better suited than the PC to the tasks of technical applications (even the PC's stepbrother—the CS9000 from IBM Instruments—was clearly a more serious research machine).

Today, the idea of using the PC in scientific and engineering applications is no longer a laughing matter. Everyone from Wall Street to Main Street knows that the business community has embraced the PC in dramatic fashion and made it the de facto microcomputer standard. As a result, the PC's suitability for technical applications has changed in at least two ways.

First, the marketplace has exploded with third-party firms eager to cash in on the PC bonanza. As a result, hardware and software have become available that make scientific applications on the PC possible, even attractive. Second, corporate and academic business people—for various nontechnical reasons such as standardization and quantity discounts—are starting to encourage (coerce?) their technical colleagues into considering the PC.

This is the first of a new series of articles devoted to scientific

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BY ED BOGUCZ

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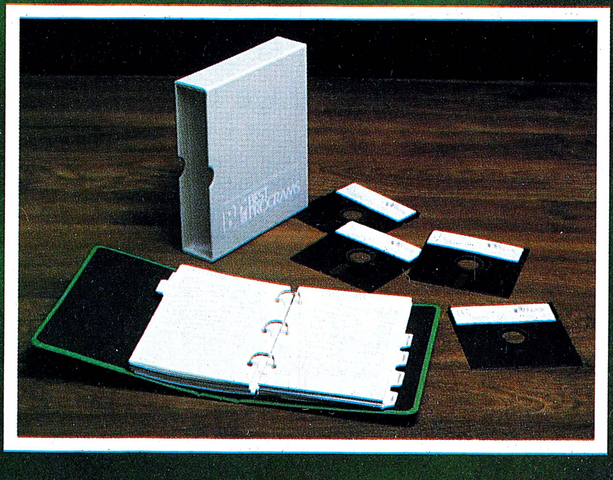

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and engineering applications of the IBM Personal Computer. The series will discuss the problems and pleasures of using the PC in such applications. We'll be reviewing hardware and software and discussing computer theory and practice. (Note that the term *PC* as used here includes the XT, XT/370, and 3270-PC.)

This series will also serve as a clearinghouse for user experiences with the PC. Topics for future articles include large-scale number-crunching, data acquisition, digital signal processing, data analysis, graphics, and compiler benchmarks. In addition, such problems as word processing for technical papers and personal reprint collection management will be considered. Readers willing to share experiences through this space are invited to write to the author, care of *Softalk/IBM* (Box 7040, North Hollywood, CA 91605).

The intended audience for these articles includes managers and lay people with interests in scientific computing, as well as scientists, engineers, and programmers. Thus, general introductory material will always be provided before any detailed technical discussion begins. References for further study will be indicated whenever possible. Ideally, something will be here for anyone interested in scientific applications of the PC.

A final comment before we begin: This series is named, of course, after the *original* computing machine, designed by the English mathematician and inventor Charles Babbage (1792—1871). Babbage conceived his Analytical Engine, a steam-driven mechanical device, with scientific and engineering uses in mind. In his autobiography, Babbage recalls the conception of the calculating engine:

"One evening I was sitting in the rooms of the Analytical Society at Cambridge, my head leaning forward on the Table in a kind of a dreamy mood, with a Table of logarithms lying open before me. Another member, coming into the room and seeing me half asleep, called out, "Well, Babbage, what are you dreaming about?" to which I replied, "I am thinking that all these Tables (pointing to the logarithms) might be calculated by machinery."

Babbage's autobiography makes fascinating reading for anyone interested in the history of computers. See *Charles Babbage and His Calculating Engines*, edited by Philip and Emily Morrison, Dover Publications, 1961.

PC NUMBER-CRUNCHING

With the intent of the original Analytical Engine in mind, let's begin by considering the use of the PC in large-scale scientific and engineering calculations. In this area, the story really concerns the Intel 8087 Numeric Data Processor (NDP), because the 8087 makes serious large-scale computation on the PC practical. This month, we'll take a broad look at why the 8087 is so significant and what can be expected of a PC equipped with an 8087. In a subsequent article, we'll review 8087 application software and provide some benchmark results.

Intel's 8087 is specially designed for numeric calculations. The NDP is essentially a sophisticated and versatile scientific calculator for the PC. It performs basic arithmetic operations and also executes several built-in transcendental functions, such as tangent and log functions.

Every PC has a socket on its system board for the 8087. The chip can be ordered as an option on new machines or purchased separately (from IBM or others).

The 8087 has two main attractions: speed and accuracy. Equipped with an 8087, a PC can do basic floating-point arithmetic operations and transcendental function evaluations ten to two hundred times faster than without it. As a result, computation times for number-crunching programs running on a PC with an 8087 (and appropriate supporting software) compare favorably with most minicomputers and mainframes, especially when the costs of the machines are also compared. In addition, the speed of the 8087 makes many new engineering applications practical on the PC, including real-time process control and data acquisition.

In operation, the 8087 works as an extension of the PC's central processor, the Intel 8088. From a programmer's standpoint, the two chips combine to form a single, extremely powerful processing unit. The 8087 extends the 8088 by providing a new workspace designed for high-accuracy arithmetic operations, as well as several new data types and new instructions for computations. The consequences of each of these are discussed below.

8087 REGISTERS

The new workspace consists of eight eighty-bit registers and several associated control words and pointers. The 8087 and 8088 registers are shown in figure 1. Note that figure 1 shows the registers "to scale" (the width of a register in bits is proportional to its width in the figure); this demonstrates clearly the significance of the 8087 registers: They provide the equivalent capacity of forty of the 8088's sixteen-bit registers.

The size of the 8087's registers is one key to the chip's speed. Single-precision (thirty-two-bit) and double-precision (sixty-four-bit) floating-point numbers can be loaded completely into the NDP for speedy internal processing. In contrast, the 8088 operating alone must manipulate floating-point numbers in sixteen-bit chunks, which results in much slower computations.

Numbers are stored in the 8087 registers in a floating-point format called *temporary real*, which is illustrated in figure 2. The temporary real format uses sixty-four bits for the significand, fifteen bits for the exponent, and one bit for the sign; this gives the 8087 a range of 3.4×10^{-4932} to 1.2×10^{4932} and a precision of about nineteen decimal digits. (It is assumed here that the reader is familiar with standard data types—integers and reals—as well as how real numbers are stored in floating-point formats. For more information in this area, see Gary Little's "How Basic Stores Numbers," *Softalk/IBM*, June 1983.)

All calculations by the NDP are performed in the temporary real format; thus intermediate results have range and precision beyond that of standard floating-point numbers stored in memory. Double-precision (sixty-four-bit) reals typically have a range of between $10^{\pm 38}$ and $10^{\pm 308}$ and a precision of fifteen to seventeen decimal digits, depending on the format used.

This arrangement has two practical consequences. First, use of the NDP generally reduces truncation and rounding errors, especially if the

> THE 8087 AND THE 8088 WORK SIMULTANEOUSLY WHENEVER THEY CAN DO SO WITHOUT INTERFERING WITH ONE ANOTHER.

intermediate results of extended calculations can be kept in the 8087 registers. Second, underflows and overflows in intermediate calculations are less likely to occur. For example, when performing the calculation A ⋆ B / C, many computers will overflow when the intermediate product, A ⋆ B, exceeds the range of the floating-point number system—even though the final result would be within bounds. The 8087 computes the correct result without intermediate overflow, thanks to the extended range of the temporary real.

NEW DATA TYPES

Although the 8087 performs all its computations in the temporary real format, this format usually is transparent to the programmer. As far as the programmer is concerned, the NDP loads and stores numbers in any of the six standard data formats listed in table 1. (The temporary real format is also given in table 1 for completeness. Strictly speaking, the 8087 also can load and store temporary reals, but these normally are not used for data or final results.) Note that only one of the 8087's six formats, word integer, is supported by the 8088. So the other five represent new data types at the programmer's disposal.

The "short real" and "long real" formats correspond to standard single- and double-precision real numbers respectively. Most scientific and engineering applications should use the long real format because of its extended range and precision. In addition, little penalty in execution time is paid for the use of long reals with the 8087. Since the NDP performs all computations in its temporary real format, the particular format of an operand in memory typically has little effect on the speed of an operation. This situation is markedly different from what prevails on most minicomputers and mainframes, where double-precision calculations take considerably longer than equivalent single-precision operations. In general, the short real format should be used with the 8087 only for input data that may be imprecise or when system memory limitations are a factor.

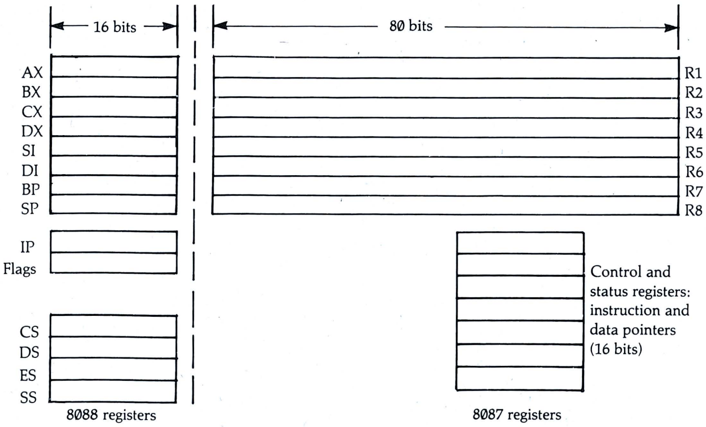

Figure 1. 8088 and 8087 registers.

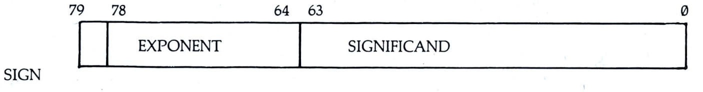

Figure 2. Temporary real format.

The packed decimal data type may be unfamiliar to many scientists and engineers. Also frequently called *binary coded decimal (BCD)*, the packed decimal format encodes one decimal digit in every four bits of data storage space. This format allows numbers of up to eighteen decimal digits to be processed exactly (seven bits of the eighty-bit data field are unused). The packed decimal data type is appropriate for financial and accounting applications where round-off errors mean money losses that cannot be reconciled.

During load and store operations, the NDP automatically performs the conversion between temporary real and any of the six data types. That the conversions are made and that computations are performed on the converted numbers is of little concern to the programmer; correct numerical results in any given data type are always obtained. Indeed, it should be clear that this scheme allows the NDP to perform calculations involving data of different types without difficulty.

The 8087 data types conform to the recent IEEE standard for microcomputer floating-point arithmetic; their use represents a step toward portability of data between programs and computers. (Note that the IBM PC languages Basic, Pascal, and Fortran do *not* use the IEEE standard data format for floating-point numbers. Thus, to be processed by the NDP, numbers must be converted to IEEE format; they must then be converted back to IBM format after the 8087 is finished. In practice, this is a nuisance but not a major problem.)

NEW INSTRUCTIONS

The 8087 adds sixty-nine instructions to those already available on the 8088. Included are instructions for data transfer (load and store for

Data Type	Total Bits	Exponent Bits	Significant Bits	Significant (Decimal) Digits	Approximate Range (Decimal)
Word Integer	16	—	—	4	$-32{,}768 \le X \le +32{,}767$
Short Integer	32	—	—	9	$-2 * 10^{9} \le X \le +2 * 10^{9}$
Long Integer	64	—	—	18	$-9 * 10^{18} \le X \le +9 * 10^{18}$
Packed Decimal (BCD)	80	—	—	18	$-999{,}999{,}999{,}999{,}999{,}999 \le X \le +999{,}999{,}999{,}999{,}999{,}999$
Short Real	32	8	23	6–7	$8.4 * 10^{-37} \le \lvert X \rvert \le 3.4 * 10^{38}$
Long Real	64	11	52	15–16	$4.2 * 10^{-307} \le \lvert X \rvert \le 1.7 * 10^{308}$
Temporary Real	80	15	64	19	$3.4 * 10^{-4932} \le \lvert X \rvert \le 1.2 * 10^{4932}$

Table 1. 8087 data types

each data type; exchange), arithmetic operations (add, subtract, multiply, divide, square root, and so on), comparison operations, and processor control. Significantly, the 8087 also includes instructions for several important transcendental operations (tangent, arctangent, exponentiation, and logs); implementing these functions in hardware greatly cuts their calculation times.

The NDP instructions allow an assembly language programmer the flexibility of addressing the 8087 registers either as a stack or as a fixed register set. Operating the registers as a stack usually makes for easy, familiar programming; the instructions used parallel those required by popular scientific calculators that use reverse Polish notation.

The 8087 also is easy to program in practice (at the assembly language level) because it does not seem like an independent device. In assembly language programs, instructions that will be processed by the 8087 are freely mixed with those for the 8088. To the programmer, the two chips act as a single central processing unit with powerful instructions and an extended register set.

In operation, the NDP works as a coprocessor: It obtains and decodes instructions in parallel with the 8088. When the 8087 recognizes one of its instructions in the stream, it begins processing. If the instruction requires loading or storing of an operand in memory, the NDP takes control of the data bus from the 8088. The coprocessor operation of the NDP often increases the apparent execution speed of the 8088/8087 team: The 8087 and the 8088 work simultaneously whenever they can do so without interfering with one another.

REFERENCES

This article is intended to serve as a brief introduction to the 8087; it isn't meant to provide an exhaustive review of the chip. As a result, topics such as error handling and coprocessor control—although important in practice—have not been covered here. Two currently available references provide further details about the chip. The first is Intel's *iAPX 86/88, 186/188 Programming User's Guide*. This book contains a complete and clear discussion of the 8087. The second reference is *8087 Applications and Programming for the IBM PC and Other PCs*, by Richard Startz. Startz's book provides a good general introduction to the 8087, but its real value lies in its many applications programs.

A complete review of Startz's book and programs will appear in the next article in this series. Later, we'll look at how to turn the power of the 8087 loose on practical problems. As one benchmark of the NDP's speed, we'll compute a table of logs. ▲

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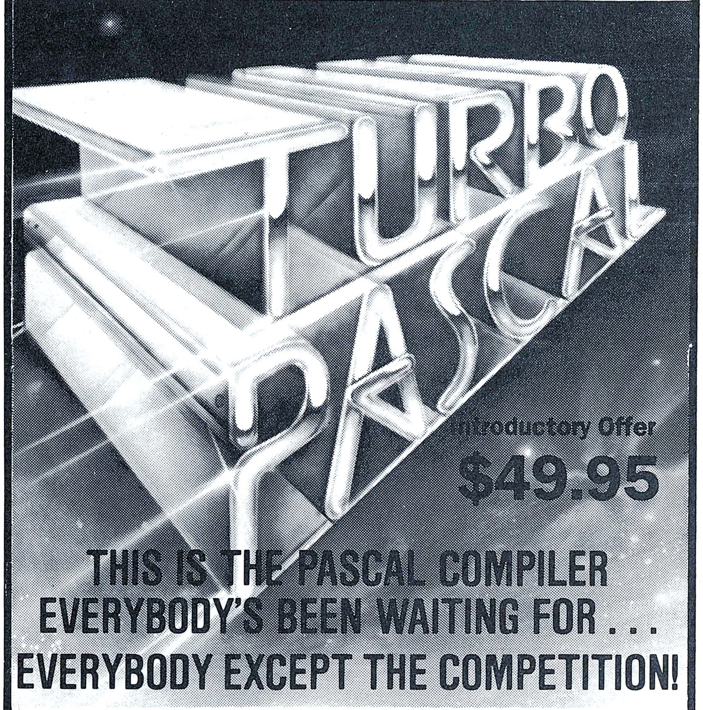
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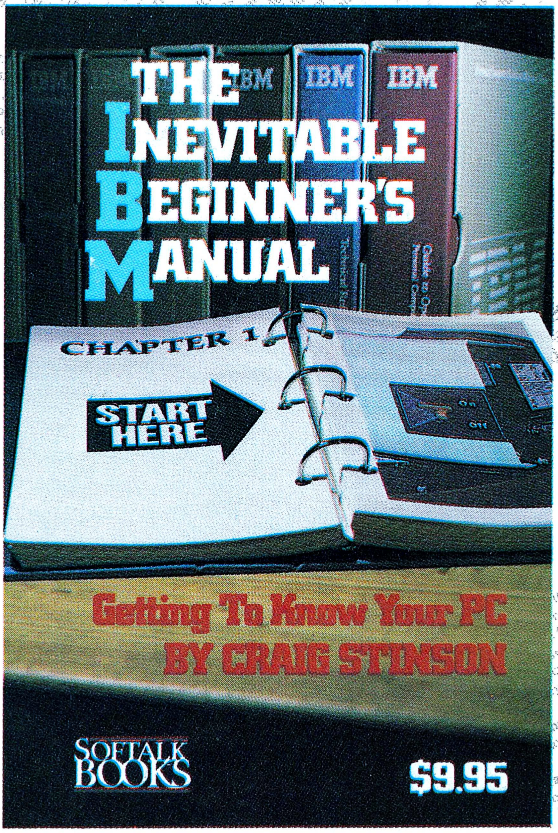

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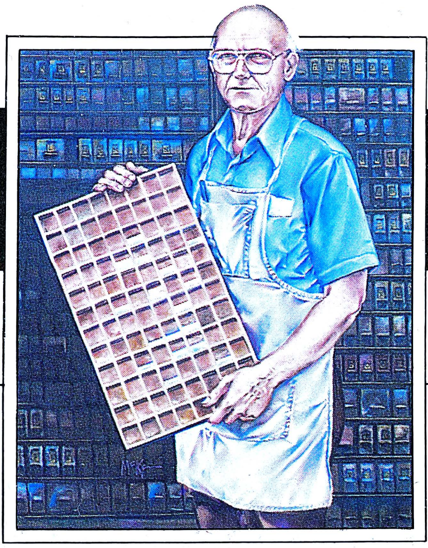

The Printed Word

by John Dickinson

The Intelligent Printer, Part V

The first part of the Intelligent Printer series introduced you to the basic concepts of printer intelligence, showed you how to use the combined intelligence of your printer and your PC to make the pair perform like a crude typewriter, and demonstrated how to get a couple of printer features to work in this typewriter mode. The last couple of installments have been designed to help you to organize your printer's features into functional areas by restructuring the technical information in your printer manual. You've also learned how to decode and understand your printer's unique programming language.

We promised that programming a printer wouldn't be the simplest thing you've had to learn about your PC, and it wasn't. You've had to learn about the hexadecimal numbering system, more about the PC's ASCII character set than you probably wanted to know, and about a programming language that's among the most obscure in the world of computers.

But if you've stuck with it, you've learned that printers, like DOS and some of the applications you use on your PC, are directed into action by a set of commands that we call printer *command sequences*. You've also learned that the command sequences are composed of language elements made up of ASCII characters and that the command language has rules that are easy to master once they're set down. It's even turned out that the language of printers is far more consistent than you might have thought the first time you thumbed through your printer manual.

However, there are still a few more things to learn about your printer's language. In particular, we haven't covered features that require variable data. But before we take up those features, it's time to start applying what you've already learned (theory is no good if you can't use it). The fine points about printer programming can wait until another time.

So, this month's column will show you how to exercise your printer's intelligence with the help of the PC's Basic interpreter. Experienced computer users won't be surprised to learn that this is the easiest and quickest way to access printer intelligence on a PC. In addition to using the printer's features directly through Basic, you'll learn some ways to set up your printer for application packages by using Basic techniques.

In later installments you'll learn how to access printer intelligence by using the printer interfaces (often called *drivers*) provided in some of the more popular PC application packages. These programs use a variety of (more or less effective) techniques to give you access to printer features; we'll be looking at some representative examples (let us know what your favorite packages are and we'll try to cover them).

If you don't know how to use Basic, you have a couple of choices. You can either try to follow along now, or you can read the "Basically Speaking" series (which begins in this issue) until you catch up with what's going on here, then come back to this installment of the Intelligent Printer series. If you aren't interested in learning Basic at all, please be patient; we'll get to application packages as soon as possible.

In the last few issues we've been using the venerable Epson MX-80 as an example printer, and we'll keep on using it for the sake of clarity and consistency. If you have been following along, you've seen us develop a handy printer reference card for the Epson printer; perhaps you've made a version of this reference card for your own printer. Just to refresh your memory, table 1 is the complete reference card, as printed last month. In final form, it provides brief and descriptive names for

General Printer Control

Name	Function	Char	Decimal	Hexadecimal
HORN	Sound printer horn	BEL	007	07H
CLEARBF	Clear printer buffer	CAN	024	18H
XFORMOUT	Disable paper-out switch	Esc 8	027 056	1BH 38H
FORMOUT	Enable paper-out switch	Esc 9	027 057	1BH 39H

Forms Control

Name	Function	Char	Decimal	Hexadecimal
FORMFEED	Form feed	FF	012	0CH
FORMLINE	Set forms to "N" lines	Esc C	027 067	1BH 43H

Vertical Line-Feed Control

Name	Function	Char	Decimal	Hexadecimal
LINEFEED	One line feed	LF	010	0AH
VT	One vertical tab	VT	011	0BH
SETVT	Set vertical tabs at "N1,N2,,,etc."	Esc B	027 066	1BH 42H
SPC6LPI	Set line feed at 6 LPI	Esc 2	027 050	1BH 32H
SPC8LPI	Set spaces at 1/8" (8 LPI)	Esc 0	027 048	1BH 30H
SPC10LPI	Set spaces at 7/72" (10 LPI)	Esc 1	027 049	1BH 31H
SPCN72	Set line feed "N"/72"	Esc A	027 065	1BH 41H

Horizontal Head Control

Name	Function	Char	Decimal	Hexadecimal
CR	Carriage return	CR	013	0DH
HT	One horizontal tab	HT	009	09H
SETHT	Set horizontal tabs at "N1,N2,,,etc."	Esc D	027 068	1BH 44H

Character-Font and Print-Control

Name	Function	Char	Decimal	Hexadecimal
COMP	Enable compressed characters (16.5 CPI)	SI	015	0FH
XCOMP	Disable compressed characters	DC2	018	12H
WIDE	Enable wide characters (5 CPI)	SO	014	0EH
XWIDE	Disable wide characters	DC4	020	14H
EMPHIZE	Enable emphasized characters	Esc E	027 069	1BH 45H
XEMPHIZE	Disable emphasized characters	Esc F	027 070	1BH 46H
DOUBLE	Enable double-strike characters	Esc G	027 071	1BH 47H
XDOUBLE	Disable double-strike characters	Esc H	027 072	1BH 48H

Table 1. Epson MX-80 printer command sequences; functional area order (including ASCII codes).

Missing an installment of "The Printed Word"? All back issues of the column—from August 1983—are still available; for further information, see page 4.

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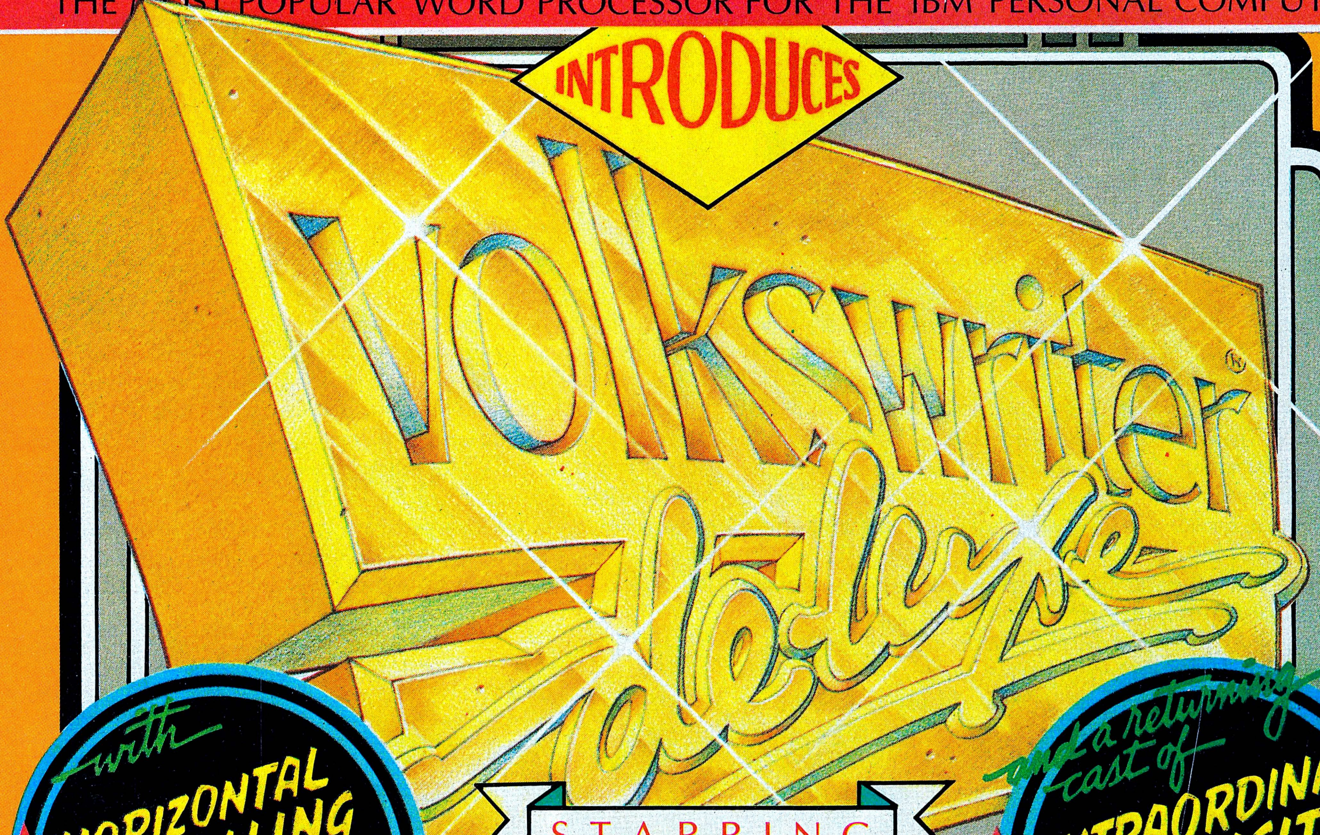

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© 1983 LIFETREE SOFTWARE, INC. • 411 Pacific, Suite 315 • Monterey, CA • 93940 each printer feature, a description of each command's use, and all of the programming information (ASCII characters in all useful formats) necessary for each command sequence. All this information is organized by functional category.

Using printer command sequence programming information in Basic is fairly easy. All you have to do is use Basic's printing ability to issue the command sequences to your printer.

Intelligent printing in Basic requires using character variables and constants, the *lprint* command, the *chr$* function, and the concatenation operator (the + symbol). Let's briefly review the relevant rules for each of these Basic features (those of you who are experts at Basic will probably whiz right past this):

- Character variable names must end with a "$" character. Character variables and constants can be made up of any combination (string) of ASCII characters that is no more than 255 characters in length.
- The *chr$* function returns the character whose ASCII position is specified as an argument inside of the parentheses. *Chr$(65)*, for example, returns the capital letter *A*, because the ASCII code for *A* is decimal 65. *Chr$* is most useful for characters outside of the printable ASCII range (such as Escape, which is *chr$(27)*), since these characters often cannot be specified by means of quote marks.
- Basic's concatenation operator ("+") is used to build up character strings (variables or constants) from individual characters or strings of characters; "+" is the glue that sets separate pieces into one variable or constant.
- The *lprint* command directs output to the printer but otherwise operates much like the *print* command (for example, the *using* option is available to *lprint* as well as to *print*). *Lprint* may not direct output to a file, but you can use *print* to treat the printer as a file if you wish (see your Basic manual for details).

With that out of the way, let's get going.

Start Basic as you normally would. As soon as the usual Ok prompt appears, you're ready to begin making intelligent use of your printer from Basic.

Let's start with something simple. Back when we were using the PC and printer combination as a typewriter, you learned to issue a *form* (or *page*) *feed* command sequence. Recall that the ASCII character code for *form feed* (12) is not on the PC's keyboard, so we used the alt key and the numeric keypad to generate the character. The *form feed* character is standard on all printers, so the exercise worked on any printer you had attached to your PC.

We'll issue a *form feed* command sequence again, but this time we'll use Basic's *chr$* function to do it. Like our previous example, this one will work on any brand of printer. Be sure your printer is on and that it's on-line before you type the following into Basic:

```
LPRINT CHR$(12)
```

Your printer should have ejected a page of paper, just as it did last month when you sent it an alt-12.

What did we do? If you look at your Epson MX-80 reference card you'll see that the command sequence we named FORMFEED is one of the simple (single-character) commands and that its decimal ASCII code is 12. *Chr$(12)* is Basic's version of that ASCII code, and our *lprint* command told Basic to send this code to the printer.

If we had wanted to, we could have typed:

```
LPRINT CHR$(&H0C)
```

instead. Had we done this, we'd have asked Basic to print the character code whose hexadecimal value is 0CH (&H tells Basic that the number following is in hexadecimal notation). Looking back at table 1, you'll see that this 0CH is hex for decimal 12, so we'd have done the same thing as we did in the previous example.

Well, that was simple enough. Any of the single-character command sequences can be sent to the printer in a similar way. For example, if your printer comes equipped with a horn or beeper, issuing

```
LPRINT CHR$(7)
```

will make your printer's horn beep.

How do you send a two-character command sequence to the printer? You use Basic's concatenation operator. For example, to get an MX-80 to print in double-strike mode, type the following into Basic:

```
LPRINT CHR$(27) + CHR$(71)
```

Once again, we've asked Basic to use the *lprint* command and *chr$* function to send the correct ASCII character codes for the double-strike printing command sequence to the MX-80 printer. The only real difference between this and the previous example is that this time we had to use the concatenation operator to send two characters at once. (Use your new reference card to find the correct values for double-strike or a similar feature on your printer.)

To prove to yourself that you're in double-strike mode, type the following into Basic:

```
LPRINT "This Line Is Printed with Double-Strike"
```

To return the printer to its normal printing mode, you have to use the command sequence that disables double-strike printing. For the MX-80, you can do this by typing

```
LPRINT CHR$(27) + CHR$(72)
```

Follow that with

```
LPRINT "This Line Is Printed Normally"
```

and you should find an honest message printed in the normal (light) font.

We could have used the hexadecimal ASCII values for these command sequences, just as we did for *form feed*. In this case:

```
LPRINT CHR$(&H1B) + CHR$(&H47)
```

would have enabled double-strike printing, and

```
LPRINT CHR$(&H1B) + CHR$(&H48)
```

would have disabled it, returning things to normal.

From Basic, there's one other way to issue certain command se-

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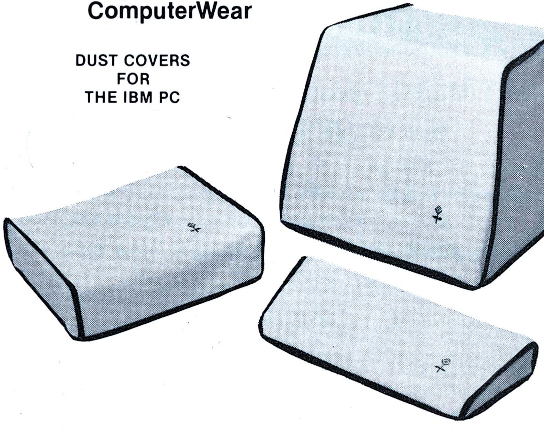

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quences. We could have enabled and disabled double-strike mode on the Epson MX-80 by issuing

```
LPRINT CHR$(27) + "G"
```

and

```
LPRINT CHR$(27) + "H"
```

respectively. In command sequences that include a printable character (as escape-G and escape-H do), we don't have to specify the ASCII value for the printable character. We can simply type the character itself, surrounded by quote marks; don't forget the quotes; Basic won't understand if you do. (Notice that we can't type the Escape character directly into Basic. Why not? You guessed it: Press the Escape key and the whole line you're trying to type sails off into oblivion as Basic—one of the SoftWares of ASCII—takes a day off to celebrate the Great Escape.)

This method is preferred by some people, but it does have disadvantages. Basic translates most alphabetic characters into uppercase letters even if you type them in lowercase. It does not, however, translate lowercase letters surrounded by quotes into uppercase. The fact that Basic has different ways of treating characters inside and outside of quote marks makes it easy to make mistakes. For example, if you type:

```
lprint chr$(27) + "g"
```

the "g" will not be translated to a "G", and the correct command sequence will not be sent to the printer.

Sometimes nothing bad will happen if you transmit an incorrect command sequence to your printer; sometimes, in fact, nothing at all will happen. But at other times an incorrect command sequence can "crash" your printer. The printer is, after all, just another computer and is just as subject to hard landings as your PC. You'll know when you've crashed your printer—it will lock up and cease to function. The only thing you can do in that event is "reboot" the printer by switching it off and then on again (you'll lose any feature settings that you may previously have made).

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In general, you're better off sticking with decimal or hexadecimal ASCII codes and the *chr$* function. If you're worried about remembering the ASCII values, you can just keep your reference card handy.

If you're going to use printer features from Basic on a regular basis, there's something else you can do that will relieve you from having to remember the printer command sequence codes (and type the somewhat awkward *chr$*) every time you want to use them. When we used the *lprint* command to send printer command sequences a moment ago, we printed character *constants*, such as *chr$(27)* or *"F"*. There's no reason we can't print character *variables* instead. For example, we could type:

```
FORMFEED$ = CHR$(12)
LPRINT FORMFEED$
```

and get a new page of paper fed into the printer, just as before. Notice that our new reference card has a short but descriptive name already defined for *formfeed* and other variables (you'll see another good use for the names further on in this column).

We can define Basic character variables for any of the MX-80's (or your printer's) printer command sequences. We have to use Basic's concatenation operator for command sequences requiring more than one character, just as we did when we used constants. To define a variable for the MX-80's double-strike print mode, type the following into Basic:

```
DOUBLE$ = CHR$(27) + CHR$(71)
LPRINT DOUBLE$
LPRINT "This Line Is Printed with Double-Strike"
```

We can be even a little more clever in our use of command sequence variables:

```
XDOUBLE$ = CHR$(27) + CHR$(72)
LPRINT XDOUBLE$ + "This Line Is Printed Normally"
```

The last line combines and prints one of our new Basic variables with a character constant; the effect is to return the MX-80 to normal printing and print the message contained in the constant.

We can create even more complicated variables by combining more than one command sequence into a variable. For example, we could define a variable to enable the MX-80's double-strike and compressed print modes simultaneously:

```
COMP.DOUBLE$ = CHR$(15) + CHR$(27) + CHR$(71)
```

We can achieve the same result by concatenating two previously defined variables—as, for example:

```
COMP.DOUBLE$ = COMP$ + DOUBLE$
```

A more permanent solution would be to use Basic's deferred mode. The program in listing 1 defines variables for all of the MX-80 command sequences discussed so far. You might notice that the program maintains our functional organization and includes comments containing descriptions of the variables. In a given Basic program, you may need to define variables for only a subset of your printer's command sequences, but it's a good idea to start off with the entire list and remove the ones you don't need after you complete your program.

All that the program in listing 1 does is define variables. If you want, you can type this program in, run it, and then just use these variables in direct mode. (You'll probably want to save the program first.) However, just in case you want to use the variables in more permanent (deferred mode) programs, here are a couple of ways to do that.

Listing 2 is a simple addition that you can make to listing 1. The additional code first prints one line normally and then prints one line in each of the Epson's enhanced modes (including the combined enhanced modes). Each enhanced print mode is disabled after it has been used. This should help you determine exactly what effect each one has.

All of the programs, as printed, run correctly on all Epson models, the IBM Matrix and Graphics printers, and the Texas Instruments 850 printer; you should be able to write a similar program for your own

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printer if it's not one of these. Even if you don't have an Epson, these programs can be expanded and experimented with quite easily.

To put a little fun in your life, try listing 3. This somewhat whimsical program seems to draw crowds wherever it runs. The program loads the Epson's command sequences for various font sizes into a character variable array and randomly selects which font to use. It may look like just a "fun program," but it can teach you a lot about your printer.

Two small points should be made about the Basic code printed in listing 3. The first is about the use of *width*. By setting the printer's width to 255 characters (that's the longest it can be) we avoid having Basic insert a line feed after every eighty characters. This printer "feature" is a hangover from the days when Basic operated only on Teletype terminals that stopped operating correctly if line feeds weren't inserted. The other point is that each *lprint* command is followed by a semicolon. This procedure's purpose also is to avoid line feeds; if we omitted the semicolons, *lprint* would insert a line feed after each character string we printed.

As the program stands, it will put out about a half page of continuous random fonts. See if you can modify it to make it produce more (or less) output. Try including emphasized and double-strike modes in the selection array. On most matrix printers there's a conflict between some of the print modes and font sizes; you can use this program (or variations of the program in listing 1) to discover what conflicts exist on your machine. The array in listing 2 can also be made larger for more capable printers—such as Graftrax-equipped Epsons and IBMs. Change the use of the *rnd* function to reflect the larger number of choices if you do this.

You're all set now to use intelligent printer features in Basic programs, but we promised just a little bit more this month. It's easy to see that a Basic program could be run to set up your printer for another program, but how can you set it up without going through the trouble of running Basic?

There are two ways, although one of them requires your making a brief pass through the Basic interpreter.

Suppose you want your printer set up for the compressed print mode so that you can print a file that won't fit in eighty columns. The first method requires you to write the following small Basic program:

```
1000 COMP$ = CHR$(15)
1010 LPRINT COMP$;
1020 SYSTEM
```

Be sure to use the right command sequence for your printer. Save the program as "Comp.bas" on your working disk, then check it to make sure it works correctly (you have to save it before you run it, since the program includes a *system* command to return you to DOS).

To use the program, make sure you have a copy of either Basic.com or BasicA.com on your working disk, then type in the following at the DOS prompt:

```
A>BASIC COMP
```

After a brief pause (on PCs you'll barely notice the pause, but it will be a little longer on compatibles without ROM-resident Basic), you'll be back in DOS. Your printer will then be ready to do your printing in compressed mode.

You may find this method something of a nuisance if you don't normally keep a copy of Basic on your working disk, so here's an easier and faster way to do the same thing. Again, you have to write a little Basic program, but you don't have to run this one every time you want to set up your printer. Here's the program:

```
1000 OPEN "COMP" FOR OUTPUT AS #1
1010 PRINT #1, CHR$(15);
1020 CLOSE #1
```

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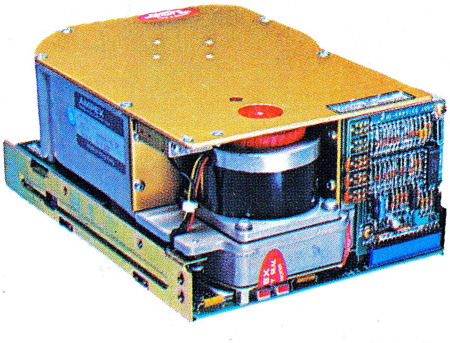

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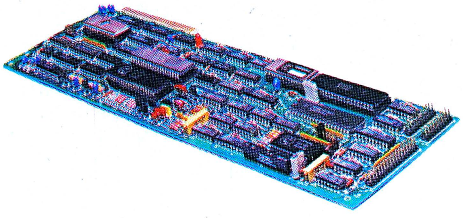

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Save the program under whatever name you choose; then run it. A file, named Comp, will be created containing the command sequence for the MX-80's compressed font. This is another good use of the mnemonic names from your reference card. Now you can see why we suggested using eight or fewer characters for the names—in order to comply with DOS filename rules.

After you've created the file, you can use DOS's *copy* command to transmit the Comp command sequence to your printer and set it up for compressed printing. Just type the following at the DOS prompt:

```
A>COPY COMP LPT1:
```

and your printer will be all set to print your wide file. You can put copies of Comp—and other similar files you create—on any disk where you think you'll need them.

You can easily create batch commands to set up your printer—using either of the two methods presented here. In situations where you set up the printer the same way each time you run a given program, you can use a batch command to start the program as well as set up the printer.

Either method will enable you to load any of your printer's features, but a word of caution is in order. Many programs (including the Basic interpreter and DOS) reset the printer when they start up. This has the same effect as switching your printer off and wipes out any feature settings you may have made. The only cure for this is to use the printer driver contained in your application program to access your printer's intelligence and features. We'll explore how to do that in the next installment of the Intelligent Printer series. ▲

OKIDATA UPDATE

PC users who bought early versions of Okidata's Microline 84 printer have been facing double frustration. Not only is their printer incompatible with Epsons and with other printers supported by major software packages, but the early ML84s are also incompatible with the rest of Okidata's Microline group of printers. Later buyers of the ML84 got the Step 2 version (yours is a Step 2 if it says "Step 2" on the manual cover), which is Microline-compatible and is supported by some of the popular software packages.

For owners of the early ML84s, help is finally here in the form of a set of ROM chips. This kit makes your printer compatible with the rest of the Okidata line. The Microline 84 Step 2 chips are available without charge from Okidata's Mount Laurel, New Jersey, headquarters. All you have to do is send your name and address and a deposit check (made out to Okidata) for $50. Okidata will send you the new chips and ask you to return your originals. When your old chips are received by Okidata, your deposit check will be returned, uncashed. The address is:

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```
1100 ' *** Listing One ***
1110 '
1120 ' Epson MX-80 Printer Command Sequences
1130 '
1140 ' *** General Printer Control ***
1150 '
1160 ' Code for HORN$ - Sound Printer Horn
1170 HORN$ = CHR$(7)
1180 ' Code for CLEARBF$ - Clear Printer Buffer
1190 CLEARBF$ = CHR$(24)
1200 ' Code for XFORMOUT$ - Disable Paper Out Switch
1210 XFORMOUT$ = CHR$(27) + CHR$(56)
1220 ' Code for FORMOUT$ - Enable Paper Out Switch
1230 FORMOUT$ = CHR$(27) + CHR$(57)
1240 '
1250 ' *** Forms Control ***
1260 '
1270 ' Code for FORMFEED$ - Form Feed
1280 FORMFEED$ = CHR$(12)
1290 '
1300 ' *** Vertical Line Feed Control ***
1310 '
1320 ' Code for LINEFEED$ - One Line Feed
1330 LINEFEED$ = CHR$(10)
1340 ' Code for VT$ - One Vertical Tab
1350 VT$ = CHR$(11)
1360 ' Code for SPC6LPI$ - Set Line Feed at 6 LPI
1370 SPC6LPI$ = CHR$(27) + CHR$(50)
1380 ' Code for SPC8LPI$ - Set Spaces at 1/8" (8 LPI)
1390 SPC8LPI$ = CHR$(27) + CHR$(48)
1400 ' Code for SPC10LPI$ - Set Spaces at 7/72" (10 LPI)
1410 SPC10LPI$ = CHR$(27) + CHR$(49)
1420 ' Code for SPCN72$ - Set Line Feed at "N"/72" (12/72" = 6 LPI)
1430 SPCN72$ = CHR$(27) + CHR$(65) + CHR$(24)
1440 '
1450 ' *** Horizontal Head Control ***
1460 '
1470 ' Code for CR$ - Carriage Return
1480 CR$ = CHR$(13)
1490 ' Code for HT$ - One Horizontal Tab
1500 HT$ = CHR$(9)
1510 '
1520 ' *** Character Font & Print Control
1530 '
1540 ' Code for COMP$ - Enable Compressed Characters (16.5 CPI)
1550 COMP$ = CHR$(15)
1560 ' Code for XCOMP$ - Disable Compressed Characters
1570 XCOMP$ = CHR$(18)
1580 ' Code for WIDE$ - Enable Wide Characters (5 CPI)
1590 WIDE$ = CHR$(14)
1600 ' Code for XWIDE$ - Disable Wide Characters
1610 XWIDE$ = CHR$(20)
1620 ' Code for EMPHIZE$ - Enable Emphasized Characters
1630 EMPHIZE$ = CHR$(27) + CHR$(69)
1640 ' Code for XEMPHIZE$ - Disable Emphasized Characters
1650 XEMPHIZE$ = CHR$(27) + CHR$(70)
1660 ' Code for DOUBLE$ - Enable Double-Strike Characters
1670 DOUBLE$ = CHR$(27) + CHR$(71)
1680 ' Code for XDOUBLE$ - Disable Double-Strike Characters
1690 XDOUBLE$ = CHR$(27) + CHR$(72)
2000 '
```

Listing 1. Command sequence variable definitions

```
2000 '
2001 ' *** Listing Two ***
2002 '
2010 ' Try Out Epson MX-80 Printer Features
2020 '
2030    LPRINT FORMFEED$
2040    LPRINT
2050    LPRINT "This Line Is Printed Normally"
2060    LPRINT
2070    LPRINT EMPHIZE$ + "This Line Is Printed with Emphasis" + XEMPHIZE$
2080    LPRINT
2090    LPRINT DOUBLE$ + "This Line Is Printed with Double Strike" + XDOUBLE$
2100    LPRINT
2110    LPRINT EMPHIZE$ + DOUBLE$ + "This Line Is Printed with Emphasis" +
          " & Double-Strike" + XEMPHIZE$ + XDOUBLE$
2120 '
```

Listing 2. Enhanced print modes

```
3000 ' *** Listing Three ***
3010 '
3020 ' Set up command arrays for Epson MX-80 character sizes
3030 '
3040 COMMANDS.ON$(0) = "":   COMMANDS.OFF$(0) = ""   :
       MSG$(0) = "Normal"
3050 COMMANDS.ON$(1) = COMP$:COMMANDS.OFF$(1) = XCOMP$:
       MSG$(1) = "Compressed"
3060 COMMANDS.ON$(2) = WIDE$:COMMANDS.OFF$(2) = XWIDE$:
       MSG$(2) = "Wide"
3070 COMMANDS.ON$(3) = COMP$ + WIDE$: COMMANDS.OFF$(3) = XCOMP$ + XWIDE$:
       MSG$(3) = "Wide - Compressed"
3080 '
3090 ' Random Epson MX-80 printer font sizes
3100 '
3110 WIDTH "LPT1:",255
3120 '
3130    LPRINT FORMFEED$
3140 '
3150    RANDOMIZE VAL(RIGHT$(TIME$,2))
3160    FOR TIMES% = 1 TO 100
3170       COMMANDS% = INT(RND * (3 + 1))
3180       LPRINT COMMANDS.ON$(COMMANDS%) + "Font is: " + MSG$(COMMANDS%)
           + " *** " + COMMANDS.OFF$(COMMANDS%);
3190    NEXT TIMES%
3200 '
```

Listing 3. Random character fonts

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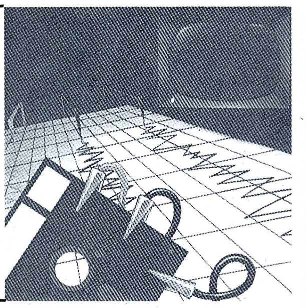

Unless otherwise indicated, software listed runs in DOS 1.1 or 2.0 with either display adapter and requires 64K and at least one disk drive.

First Impressions: Thirteen PC*jr* Programs

Animation Creation takes up to eight screens in forty-column mode (or four screens in eighty-column mode) and flashes one after the other on your PC*jr*'s display, creating animated words and pictures. It's an easy-to-learn program, particularly if you follow the examples in the documentation; and you can achieve sensational animation with a little forethought. You have eight background colors and sixteen foreground colors, the entire IBM character set (including the extended ASCII characters), and an array of blocks and lines to work with, so the possibilities are pretty extensive. However, you can't really draw freehand; frustratingly, all figures have to result from combinations of straight lines. The documentation doesn't mention drawing with a light pen or joystick. Nonetheless, it's easy to get the hang of creating and animating, and you'll find yourself playing with the program for hours. Mystifyingly, the system on *Animation Creation*'s program disk is DOS 1.1; if you try to save your work on a nine-sector disk, you get a "disk full" error message. Remedy this by using the *format/8* command to create disks for use with *Animation Creation*. $40.

Monster Math merely drills you—or your children—on math basics: addition, subtraction, division, and multiplication. The monsters (there are two) disappear as you type in the correct answers to the problems. (Think fast: What subtracted from 44 gives you 21?) However, the monsters do not eat you when you're done, and they don't evaluate your mathematical ability. They just flash problems at you, one after the other, and respond to your input (a bit sluggishly—probably no problem for a six-year-old). *Monster Math* is written in Basic and is used in conjunction with the Basic cartridge. $30.

Adventures in Math, a disk-based educational game that also can be played on the Junior's bigger cousins, serves the same drilling purpose as *Monster Math*. The math problems are still basic addition, subtraction, multiplication, and division, and they must be solved to open doors and pick up treasures in a spooky castle. The castle itself is a three-dimensional, floor-view maze, and the game ends when a player opens enough doors to find the exit. If a player answers incorrectly when a treasure is at stake, a spider descends and snatches the prize away. The castle comes in three sizes, and the player can choose what types of problems will be presented, but the difficulty of the problems themselves is not a variable. The game saves high scores in a Hall of Fame, which might provide some added incentive for youngsters. *Adventures in Math* requires Cartridge Basic. $35.

Bumble Games includes six games that teach children how to plot number pairs, introducing the idea of positive and negative numbers and coordinates. The games get progressively more difficult. "Find Your Number" has you trying to pick the number the game has selected from a single-axis number line; if you don't get it the first time, you are coached to select a smaller or larger number. "Find the Bumble," "Butterfly Hunt," and "Visit from Space" have you looking for Bumble, Bumble's butterfly, and Bumble's cousin's spaceship, respectively, by naming the x,y coordinates where they might be located on progressively more complex fields. "Tic Tac Toc" has you typing in x,y coordinates as locations for your tic-tac-toe moves, and "Bumble Dots" makes you give the locations for dots on a ten-by-ten grid to draw whales and the like. Aimed at the preschool to fourth grade crowd. *Bumble Games* requires Cartridge Basic. $40.

Bumble Plot is intended for a slightly older crew (children 8 through 13) than *Bumble Games*; the math-anxiety-stricken adult might also find them edifying. "Trap and Guess" requires, again, that you guess the number from those given on a seven-number axis; this one will go on forever until you pick the right answer. Also, during testing, one screen went blotto and colored itself up—the scale couldn't be seen, although something was going on under all that cyan. As for the other games: You trap an insect in "Bumblebug" by providing coordinates, provide coordinates for treasures in "Hidden Treasure" (one of the more sprightly Bumble games), name dots' locations (again) in "Bumble Art," and name coordinates to put impediments in front of a moving car in "Roadblock." *Bumble Plot* requires Cartridge Basic. $40.

Juggles' Butterfly introduces preliterate children to the concepts of above and below, left and right (good for adults who only know their

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This utility program will create a 'fancy' listing onto the printer. It will print any file on the disk which is stored in ASCII format. The following will be printed at the top of each page:
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- Date
- Program file name

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The subroutine provides a simple way to draw:
- A rectangle
- A verticle line (with or without 'T' ends)
- A horizontal line (with or without 'T' ends)
- Lines may be either single or double lines

'INPUT', 'MESSAGE', & 'CHANGE' BASIC SUBROUTINE
The 'input' subroutine will allow you to specify the length of input, type of input and redisplay format. The following types may be specified. Error checking is done on a character by character basis:
- Any ASCII character
- Only numbers
- A phone number
- A date as 'mm/dd/yy'
- A social security number
- A yes/no entry

The 'message' subroutine will display a use specified message on the 24th line and return the cursor to its original position.
The 'change' subroutine will allow you to enter a number of a field on the screen to be changed.

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- Clear to End Of Line
- Clear to End Of Screen

STRING HANDLING SUBROUTINES:
- Sort array in memory
- Convert to uppercase
- Convert to lowercase
- Strip spaces from front
- Strip spaces from end
- Print using to string

MISCELLANEOUS SUBROUTINES
- Pack a string to RADIX
- Unpack a RADIX to ASCII
- Convert string to SOUNDEX key
- Get status of SHIFT, CONTROL, NUM-LOC etc.
- Set status of SHIFT, CONTROL, NUM-LOC etc.
- Determine number of days between dates
- Determine the day of the week
- Disable the BREAK key
- Delay for number of seconds
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- Select monochrome monitor for use
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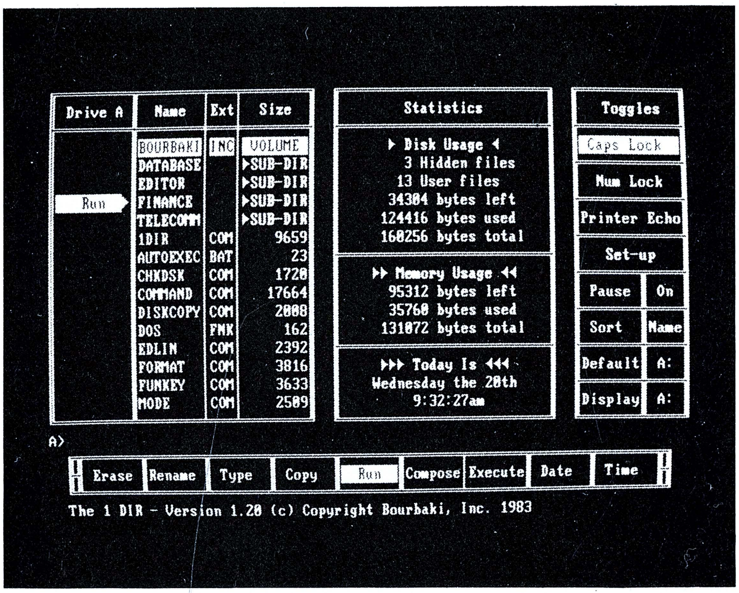

```
Drive A   Name     Ext  Size        Statistics               Toggles

          BOURBAKI INC  VOLUME      ▸ Disk Usage ◂           Caps Lock
          DATABASE     ▸SUB-DIR      3 Hidden files
          EDITOR       ▸SUB-DIR     13 User files            Num Lock
  Run ▸   FINANCE      ▸SUB-DIR     34304 bytes left
          TELECOMM     ▸SUB-DIR     124416 bytes used        Printer Echo
          1DIR     COM     9659     160256 bytes total
          AUTOEXEC BAT       23                              Set-up
          CHKDSK   COM     1720     ▸▸ Memory Usage ◂◂
          COMMAND  COM    17664     95312 bytes left         Pause    On
          DISKCOPY COM     2008     35760 bytes used
          DOS      FNK      162     131072 bytes total       Sort     Name
          EDLIN    COM     2392
          FORMAT   COM     3816     ▸▸▸ Today Is ◂◂◂         Default  A:
          FUNKEY   COM     3633     Wednesday the 20th
          MODE     COM     2509     9:32:27am                Display  A:
A>
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P.O. Box 2867, Boise, ID 83701, (208) 342-5849 left hand because it has their watch on it), and up and down and left and right all at the same time. Its highlight is a dancing, taunting rainbow that won't go away. *Juggles' Butterfly* requires Cartridge Basic. $35.

Mouser is at first a little difficult to grasp for those not hypnotized by the unearthly arcade glow; it helps to make sure the keyboard is aimed properly or, if the table will keep intervening, plugged in. What you have to do is box mice off by walking through walls in such a way that they form a cubicle around the mouse. There are nine rooms—one pitch dark save for the pool of light emanating from your flashlight—and rather more mice; there is also a cat that grins and turns its head. The game is more fun than its drab name would indicate. $35.

Your task in *Crossfire* is to debug a grid of streets and avenues. The nasties come at you, firing from four directions; new ones are born as soon as you exterminate the old ones. In effect, you have to kill each bug four times before you're (momentarily) out of danger. As soon as you've cleared the streets, though, another wave of attackers arrives, obliging you to repeat the process. You start with three fighters, and at 5,000-point intervals your team is rewarded with an additional member; play continues until your side is out (the game never runs out of bugs). Your gun, like the critters, moves and fires in any of four directions; you can control your defensive and offensive operations with either keyboard or joystick. You can set the speed of the game to any of the three levels, and you can hit escape to pause when the phone rings or the action gets too intense. $35.

Of the four game cartridges that IBM has released with the Junior, *Mine Shaft* is probably the easiest to play. *Mine Shaft*, which you might expect to be a ladder-type game like *Lode Runner* or *Miner 2049er*, actually is an ordinary maze game of the *Pac-Man* school. The player's mining cart goes scuttling about attempting to pick up precious gems before being annihilated by what look like overgrown mosquitoes. Once all the gems have been collected, it's on to another maze of a different color and greater difficulty. Graphically, *Mine Shaft* is unremarkable, but at least it is easy enough at the first level so that even the most incompetent game player can have some success. $35.

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Users of the PC and XT may be familiar with *PFS:File* and *PFS:Report*. IBM has licensed these programs from Software Publishing Corporation, which has had considerable success with them. Although the packages are sold separately, *Report* is useless without *File*, and *File* is of limited use without *Report*. Like most of the more sophisticated applications that IBM has marketed for Junior, these programs stress ease of use over exotic features, and even a casual user should have little trouble getting them up and running. *File* is a set of electronic index cards you can use to store information. Although the computer makes it easy to look up a particular card or set of cards, the program has no provision for sorting cards or generating other lists from cards. For that, you need *Report*. Because the menus and commands are comparable in all the PFS software products, once you know *File*, *Report* is simple to master. With this program you could, for instance, print a nicely formatted report that listed all the chili recipes you cataloged (with *File*) by their names, how hot they are, and how many people they serve—leaving out extraneous information. Of course you don't have to buy these programs from IBM (unless you have a passion for those cloth-bound binders); Software Publishing Corporation still markets them under its own name, along with *PFS:Write*, *PFS:Graph*, and the soon-to-come *PFS:Access* (a simple telecommunications program). All should run on Junior. *File*: $140; *Report*: $125.

Personal Communications Manager is a new electronic mail and intelligent terminal package that runs on the PC*jr*, PC, or XT. It's a safe bet that many people who opt for Junior's built-in modem will be using this program, which is designed to reduce telecomputing to simple one-key commands. You can define function keys as macros that will dial the phone, wait for a specified command, send a password, and issue a series of commands. This is extremely helpful for services such as CompuServe and The Source. Learning how to do all this is somewhere between easy and moderately difficult, but once the system is set up, it's easy to use. Other things you can do include sending electronic mail, sending and receiving files over the phone, and having the computer call an information service at a preset time and conduct its business in an unattended mode. This can be a time and money saver if you are working with a commercial database service. The biggest limitation of the program is its inability to support communications at 1200 baud. $100.

You can be a *HomeWord* veteran in less than half an hour if you sit down and follow the tutorial included in the documentation. Icons take you through several levels of menus to save, format, and edit files. Although it's not *MultiMate*, *HomeWord* is perfectly adequate for most letter-writing and paper-polishing needs. Now, if only the PC*jr* could keep up with a competent typist . . . . $75. JB, KTJ, CS

Serpentine

The beauty of this game is twofold. To begin with, *Serpentine* has a definite carrot-on-a-stick quality; you know that if you hadn't made that one wrong move you'd still be alive, so you find yourself trying again and again. The other appeal is that it's very well made; kudos to the programmer of the IBM version, Harold Hedelman.

Serpentine is a fresh twist in eat-'em-up maze games. You chase snakes' tails and they chase yours. It stars two teams of three snakes each: your team is red and theirs is green. An interesting aspect of the

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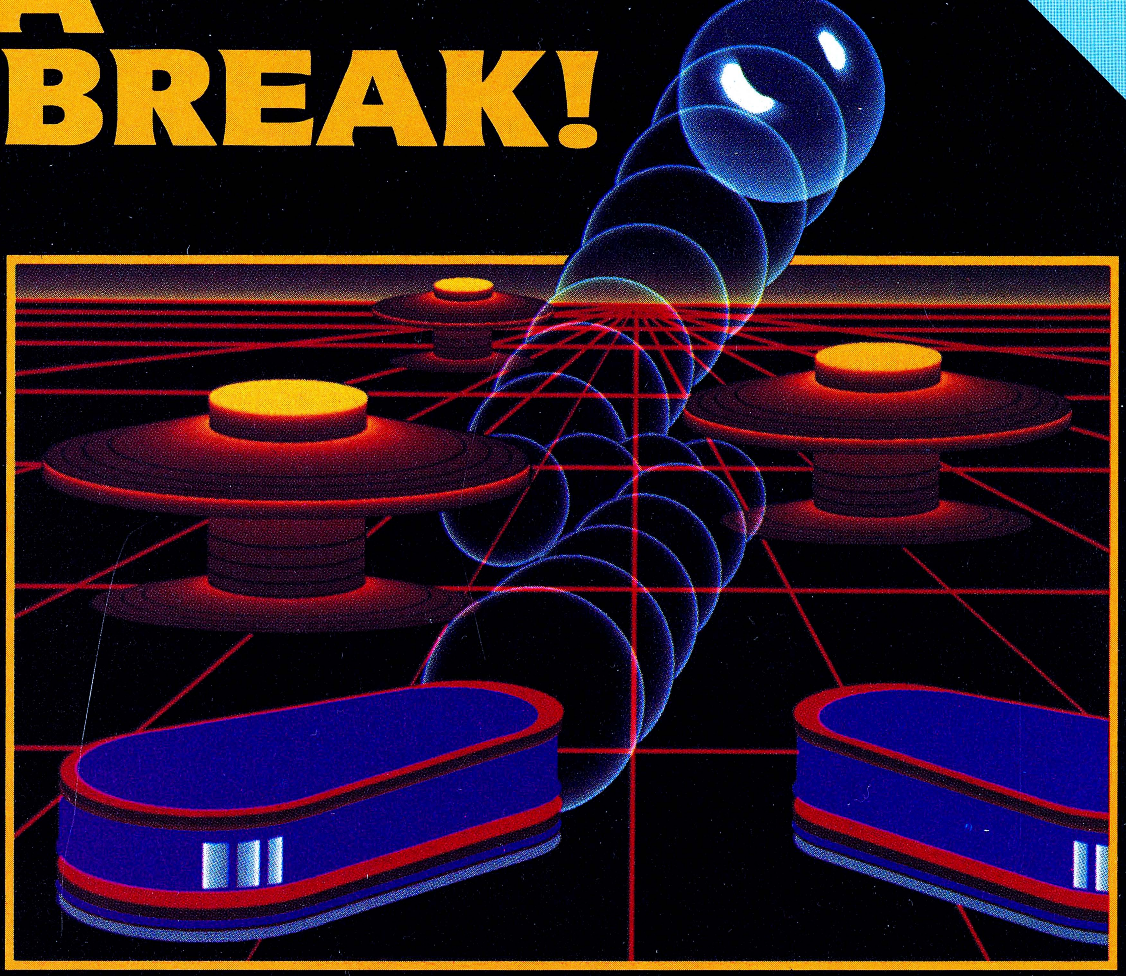

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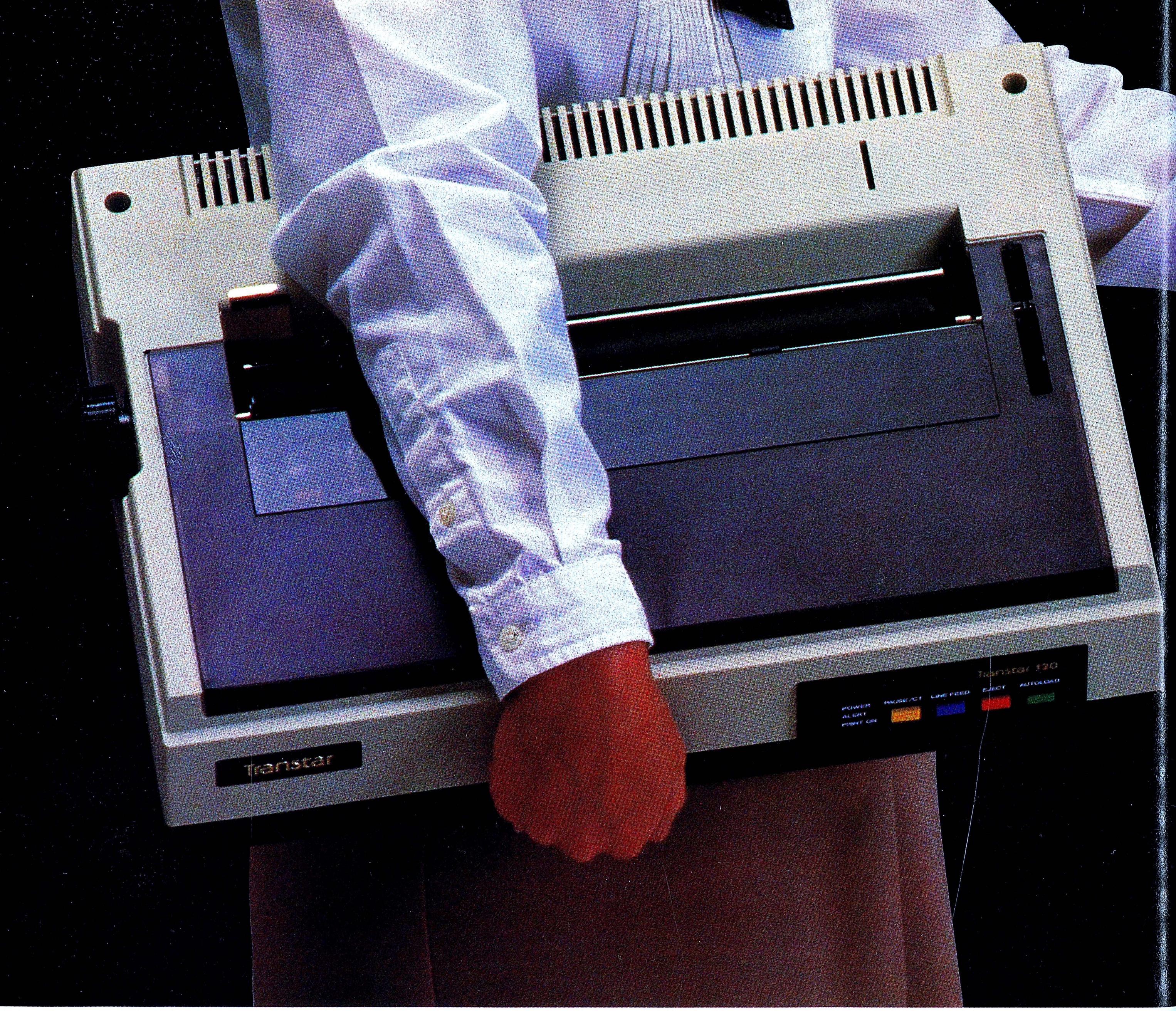
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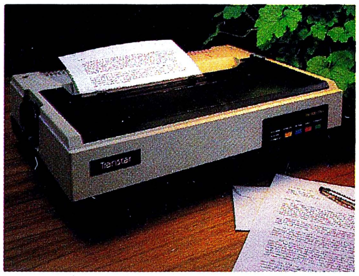

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by **Vivitar**.

competition is that both sides are at root equally matched. Only fate (and the author of the game) has made your team the good guys.

Of course, it wouldn't be an eventful match if both sides weren't given handicaps. Your team comes out of the starting gate only one snake at a time. The enemy snakes come out in threes, and they can be up to seven sections long; you're only three sections long to start. However, when the green serpents are shorter than you and have lost their spots, you can eat them whole, head on.

As the enemy serpents first slink through the maze, you should be scampering for frogs. Eat one of the many frogs that hop into the game and you grow one section. Both teams of snakes lay eggs as they whip through the maze. Theirs are speckled and turn into more pesky vipers if you don't eat them. Yours are white, and when they hatch at the end of each round (if they haven't been eaten), they zip to home base and go with you to the next of an amazing ninety-nine-plus levels (actually twenty different mazes that cycle until the game becomes unplayable).

The game is fast—at times. This sense of speed alternates with moments of ominous slowness as fat snakes creep into combat through intricate corridors of a maze.

Imagine Chinese dragons squaring off in the midst of a parade—tails whipping around corners, tight circular chases with abrupt ninety-degree turns; imagine too some beautifully exasperating flimflam as rival serpents perform crossovers and come out with heads at each end. Then imagine the slow-rolling gluttony of victory. MF

Serpentine, by David Snider. Broderbund Software (17 Paul Drive, San Rafael, CA 94903; 415-479-1170). Keyboard control only. Requires color/graphics adapter. $34.95.

4-Point Graphics

This new graphics package is pretty good, if you can figure out how to use it.

The program's name comes from one of its three line-drawing modes: four-point, two-point, and three-point. When the program is in four-point mode, the cursor, which consists of four closely grouped dots, can be split into four separate points that are used to indicate a box around some area on the screen. The top-left dot remains fixed at the original cursor point, while the others can be moved with the cursor control keys. This makes boxing in areas for rotation or copying easy.

You can draw boxes automatically by using the four placement dots as guides, but the boxes sometimes fail to complete on the composite monitor. *4-Point Graphics* uses line clipping, so some automatic functions—circle, ellipse, and box drawing, for example—allow extension beyond the screen limits. Attempts to copy an entire image that's partially off screen result in the cryptic message "UNBALANCED." This is probably not a comment about the mental state of the user, although one never knows.

The two-point mode lets the user fix a point, move the cursor, and draw a line between the two points. The only hitch in this operation is that the first point does not automatically move. You must press the Q key to advance the cursor to the second point. Of course, for certain drawings there are advantages in leaving the first point immobile.

Three-point mode is very handy and not commonly seen in graphics packages. Once you've established two positions with the two-point mode, you can fix the two established points and center a third between them. This third point then becomes the only mobile one; you can move it vertically anywhere on the screen. You can then draw a parabola or an ellipse around the three points.

A user must be in the four-point mode to copy or rotate images. Rotations, since they are done one pixel at a time, are slow. A large block—roughly half of the display area—takes nearly forty seconds to complete.

Copying a block from the screen—or restoring one—is reasonably fast. There's no way to save blocks in a library file. Blocks can be "captured" into one of two buffers and then copied back to the screen as many times as desired.

A block can be up to 312 by 180 pixels, which is the available working area on the screen. There is no direct screen-save command. The image area must always be moved to one of the two buffers before it can be saved to disk.

Images are saved in a format peculiar to *4-Point Graphics*. They cannot be retrieved with the binary *bload* command, which means that they cannot be downloaded for use with other graphics displays. However, *4-Point Graphics* does have some "slide show" capabilities that allow the user to show pictures in succession for demo and presentation purposes.

4-Point Graphics has a nice and rather unusual enlarge command. Images that have been marked by the four cursor dots can be enlarged vertically or horizontally. This process is rather slow since, like the rotate process, it is done with single pixel moves, but it's still faster than redrawing the entire image. Unfortunately, there's no way to control the direction of the enlargement. Vertical enlargement is done downward, and lateral enlargement is done toward the right.

A reduction command squeezes an image toward the top and left. This isn't quite as successful as enlargement, since the screen is in medium resolution, and fine-line (single-pixel) detail gets lost. Reenlarging the image doesn't recover the lost detail, which goes to that great bit bucket in the sky. It's advisable to store images in a buffer before experimenting with the reduction commands.

A rather interesting command is supposed to move the "queued image pixel by pixel, or continuously if in AUTO CURSOR mode." The effect of this appears to be to send the end of the image slowly into some black-hole never-never land. Presumably this command could be useful for deleting unwanted sections of a design.

In "normal" drawing, without any of the point modes in effect, *4-Point Graphics* can be used to draw circles automatically, with size and

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aspect entered by the user. Another interesting feature is the ability to draw additional circles with a single keystroke. Oddly enough, this automatic feature can be invoked only when the aspect of the circle is changed. This means that users can draw a nice set of decreasing ellipses but have to back up a step each time they want to create a series of circles of the same size and aspect.

4-Point Graphics, unlike several other graphics generators, has no high-resolution mode nor any way to create high-resolution images and incorporate them into the medium-resolution screen. There is a limited *put* animation capability that uses the buffered image blocks. There does not appear to be any way to incorporate another manufacturer's high-resolution drawings into this package.

Commands in *4-Point Graphics* usually consist of one or two keystrokes, but some of the key assignments are unnecessarily complex; for example, moving through the four-color palette requires use of two keys (F1 and F2), whereas one would be more convenient. Similarly, the F7 and F8 keys must be used to select buffers 1 and 2 respectively; a single-key toggle would have been simpler.

The manual frequently asserts that things can be done, without telling how to do them. For example, a nice "temporary test mode" will display an image on the screen for about two seconds, allowing you to check placement before making it final. The manual says "The TEST mode INDICATOR will be on in TEST mode."; unfortunately, it doesn't explain how to activate the test feature. Careful study will reveal one line on the reference sheet—hidden under the heading "Color"—that identifies the space bar as the control.

Also included in the manual is a nine-page glossary that includes terms like "Cobol," "Fortran," and "integrated circuit," which probably won't be of much help or interest to users of the program. A glossary related more to graphics would seem to be more to the point.

This package does not run under DOS 2.0. The manual also claims that the program will not run if the monochrome board is installed, and directs users to remove the board. Not only is this a nuisance, it also turns out to be unnecessary. If you put Mode.com on the *4-Point Graphics* disk and switch the display to composite monitor, you should encounter no trouble in running the program with both boards in place. It's a good thing you can run it with both boards; otherwise you'd have to reinstall your monochrome board any time you wanted to print (unless you happened to have a second printer interface).

A separate print package, on a second disk, is included with the *4-Point Graphics*. The print programs are designed to use either the Epson printer or IMSI's "Sweet P" plotter. A short guide is at the back of the manual, but, like the other documentation, it's somewhat sketchy.

A new manual and tutorial, due soon, should make this program much easier to use. Some commands are awkward and some have disconcerting side effects, but those problems are reduced with familiarity and use. The program's major limitations are the lack of high-resolution interface and the incompatibility of its finished pictures with the standard *bload* format. (Note: At publication time, IMSI had released a rewritten version of their documentation, making it much easier to use the product. This new documentation is 100 per cent better. DC

4-Point Graphics, by Jim Hamilton, International Microcomputer Software (633 Fifth Avenue, San Rafael, CA 94901; 415-454-7101). $195.

Miner 2049er

Created for the Atari more than a year ago, this popular game proved to be Top Ten arcade material on the Apple charts before it was finally translated to the PC. Serious game players will be pleased to hear nothing has been lost in the translation.

Miner 2049er bears slight resemblance to several other popular arcade games. However, it's not a copy of anything you can find at your local arcade and doesn't play like its predecessors. It manages to take the ladders and leaps from *Donkey Kong* and the blinking goblins from *Pac-Man* and turn these basic elements into a whole new game.

The object of the game is to get Bounty Bob through ten levels of fractured platforms fraught with dangers and crawling with lethal mutants. Gobbling up mining tools along your route enables you to neutralize the mutants. Points are given for both chores. Sealing the floor space on one level allows you to go on to the next.

What makes the game such a joy to play is the obvious care that went into the incorporation of these winning concepts. The play is fast and at the same time smooth (a joystick is required). The animation is smooth, too, even though Bounty Bob may be the homeliest hero ever to appear in a computer game.

Each of the game's levels is a special challenge, not just a variation of a previous one. Level 3, for example, contains a transporter, while level 6 is played over a lethal radioactive pit. Level 10 demands that you eat sticks of dynamite so you can shoot Bob out of a cannon to finish the game. And the documentation's warning about martinis is not to be dismissed.

Not a game for all-thumbs players, *Miner 2049er* requires mental finesse as well as physical dexterity. Imagine having to read a ten-chapter book from the beginning each time you lose your place and you'll know what it takes to win. In this game, a few light taps on the joystick will get you off a hairy ledge more successfully than will a heavy hand.

Miner 2049er is a great arcade game. Everything is in the right place and does what it should. If "great" seems like unqualified praise, consider how challenging, addicting, frustrating, and rewarding the best arcade games can be. *Miner 2049er* is right up there with the best and just as fun.

If an arcade game ever makes it to the IBM Top Thirty, this might well be the one. It certainly deserves to. MF

Miner 2049er, by Bill Hogue. Micro Fun (2699 Skokie Valley Road, Highland Park, IL 60035; 312-433-7550). Requires color/graphics adapter and joystick. $40. ▲

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DeSmet and Small-c:PC

A Tale of Two Cs

by Rex Jaeschke

The DeSmet C Development System and the Small-c:PC package both contain C compilers—but that's where the similarity ends. One is a complete integrated set of utilities designed for use by professional software developers, and the other is a small subset of C with some runtime library routines. Each product has its unique selling points and its unique marketplace. This review will concentrate on the features, capabilities, and applications of these two packages (for performance evaluations, see *Byte*, August 1983).

The Small-c:PC C Language Compiler

Small-c:PC is a C compiler that runs under PC-DOS. Although it implements a severely limited subset of the C language, known as small-c, that subset is useful and powerful. The fact that the compiler itself is written in small-c is testimony to the power of the subset. The vendor, Custom Software, provides documented source code for the compiler and runtime library.

Small-c is valuable in three ways. First, it allows the user to get the feel of the C language. Several demonstration programs and the compiler source itself provide useful, working examples of C. The package is also a tool for learning assembly language. The runtime library contains a set of handy assembly routines that allow C programs to make optimum use of the PC's I/O capabilities. Finally, small-c gives interested programmers a good look at the insides of a high-level language compiler. Programmers with such interests typically can't get access to compiler source code; or if they can, what they see is usually written in assembly language, so they have to learn assembler first. Looking at small-c's source is a learning exercise in C itself.

Small-c was never designed as a production language, and it should not be used or thought of as one. It is a test compiler that's valuable as a learning tool. It places no emphasis on efficiency of code generation or on execution speed, and for that reason the published benchmarks relating to its speed are not particularly meaningful.

The compiler generates assembly language suitable for input to the IBM ASM or MASM assemblers. Because you have to have an assembler, the $35 compiler price is a little misleading. For those users who haven't yet bought an assembler, small-c's educational value may well justify that purchase.

The compiler was designed to work on a 64K system with two single-sided disk drives. MASM will not run in 64K, so for small-memory systems ASM should be used instead. The compiler doesn't take advantage of the extra

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features provided in MASM, so either assembler will suffice for machines with more memory. C source code files can be compiled separately and bound together—and with any user-written assembly code routines—by means of the DOS linker.

The compiler can handle very large C programs, including itself, within 64K. However, on a 64K system, ASM may not have enough memory left over to process the assembler code generated. For this reason, the compiler source code file is provided with comments indicating where you might break it up into smaller chunks that ASM can handle. This breaking-up process is not too painful if you have a full-screen editor; the job can be done in a day or so. Programmers serious about modifying the compiler, however, would do well to have more than 64K.

The distribution kit includes a single-sided disk containing fourteen files, along with eighteen loose-leaf pages of documentation. Like all other C compilers, this one refers the user to Kernighan and Ritchie's *The C Programming Language* (Prentice-Hall, 1978) for a definition of the language. In addition to the compiler and library files, the kit includes three demonstration programs in source code format.

When you invoke the compiler, it ignores any DOS command-line arguments specified and instead prompts for arguments. The runtime library provides a function to access the DOS program segment prefix, so one possible challenge for a budding compiler modifier might be to add the *argc/argv* capability to allow the use of command-line arguments. This change would make the compiler easier to use in batch files.

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The compiler asks four questions before going to work. One question gives you the option of having the compiler pause indefinitely whenever it locates an error. Another allows you to include all C source code statements as comments in the generated assembler code file. The other questions involve input and output filenames.

No filenames or extensions are provided as defaults. This is another minor challenge for the tinkerer.

Once you've loaded the compiler into memory, you can use it indefinitely; you don't need to load it for each input file.

The error-reporting mechanism is good. Error messages are clear, and they include the source file line number, the current function name, the line in error, and the character position where the error was found. Assuming you've selected the pause-on-error option, you can choose at this point between aborting the compilation, continuing to the next error, or disabling the pause for future errors.

The library routines primarily provide I/O capabilities. As source code for all the routines is included, any limitations can be removed. A maximum of four files can be open at any one time, each having its own 512-byte buffer. Data is transferred to and from files one byte at a time, hence file operations are somewhat slow. Only ASCII files are supported.

Two types of library routines are provided: a subset of those found in generic C runtime libraries and those that allow interfaces to the PC hardware and software environment. The "standard" routines include *getchar, putchar, gets, fopen, fclose, getc,* and *putc*. The PC-specific functions allow direct access to hardware ports, the interrupt mechanism, and the DOS program segment prefix. In addition to the library routines provided, the compiler supports in-line assembler code.

It's interesting to look at the library- and compiler-generated assembler code to see how the stack and other registers are initialized and how the user program is started. The compiler-generated code is by no means optimized, but program execution speed is tolerable. The beginner, with several simple modifications to the compiler, could make significant reductions in generated code size and increases in performance.

The only data types supported are *char, int, extern char,* and *extern int*. Local and static pointers to these types are permitted, where a pointer is a sixteen-bit stack offset. Single-dimension arrays are supported. The unary operators include −, *, ++, and −−. The binary operators are +, −, *, /, %, ¦, &, ==, !=, ⟨, ⟨=, ⟩, ⟩=, ⟨⟨, ⟩⟩, and =. You can make up for the absence of the && and ¦¦ operators by using & and | instead. Constants may be decimal numbers, quoted strings (such as "Hello") and primed strings (such as 'A'). Escape sequences, such as \n, \t, and so on, are not supported.

The supported statements are *if-else, while, break, continue, return,* and ";". Statements may be compounded with braces. Preprocessor commands allowed are *#define, #include,* and *#asm*. *#define* macro expansions are not supported, however. All generated code is pure and reentrant. As local variables are created on the stack, recursion is allowed.

The compiler makes only one pass through the source code. Therefore, undefined variables are assumed to be external function names (even if they aren't followed by parentheses) and aren't detected until link time.

Despite the omission of many statements and constructs, enough of the C language is available to allow the user to build valuable library routines for string handling and formatted character I/O. The library has no *printf* equivalent, so the user quickly develops routines for inputting and outputting decimal and hexadecimal values. It's impossible to implement the standard *printf* function since function arguments are pushed on the stack in the same order as they appear in the source code; so the called subroutine has no idea where on the stack the critical first argument is; however, nonstandard versions of *printf* are relatively easy to implement.

The documentation is brief, clear, and adequate, but you'll need some advanced programming knowledge to assimilate it completely. Examples show how to use the compiler and assembler to build the sample programs provided. Each of the library routines is discussed in detail, as is the assembly language interface. One section covers runtime code structure and segment usage. The three-page appendix documents the capabilities and limitations of the small-c language subset.

Small-c:PC was priced to allow the authors to recover their development costs. Hence, no organized support mechanism is available. As source code is provided for all routines, the user has the tools to debug, fix, and enhance all the programs.

The bottom line is that Small-c:PC is an affordable and powerful tool ideal for those who wish to develop or improve their C, assembler, and compiler internals knowledge.

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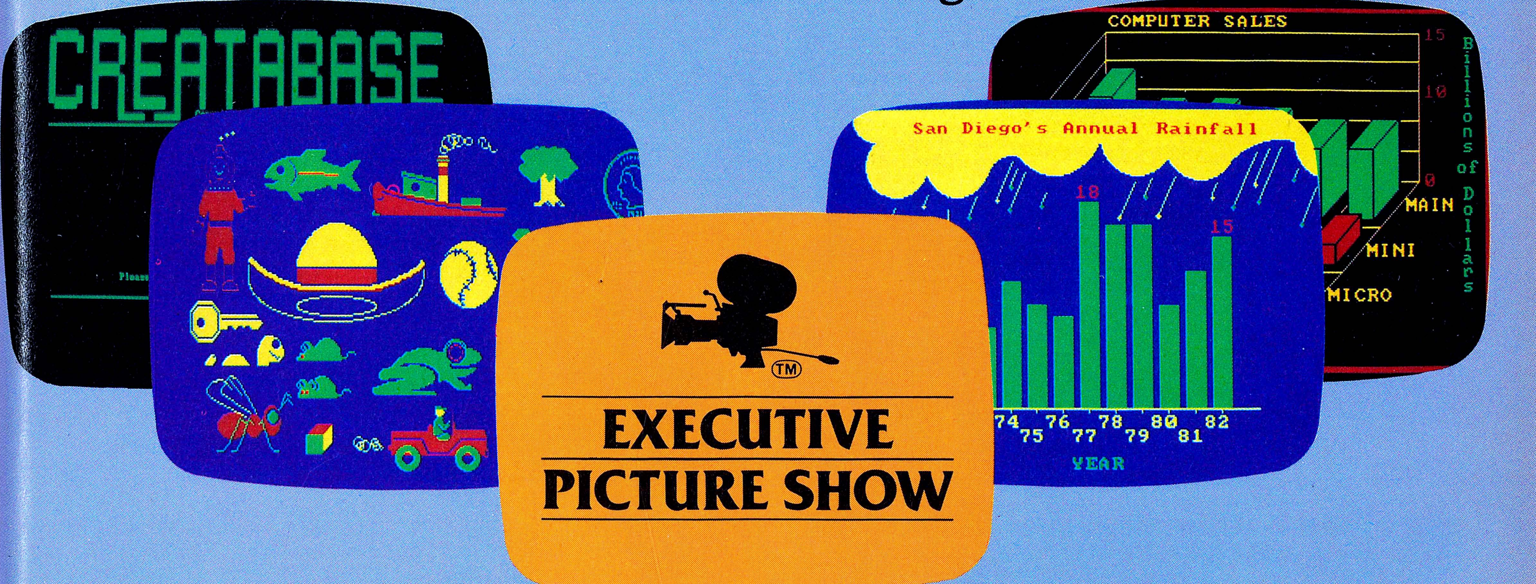

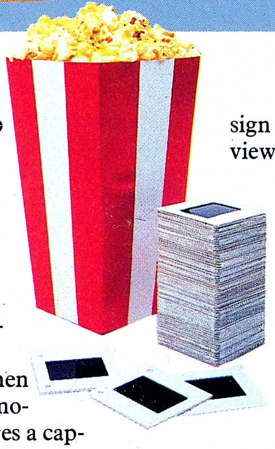

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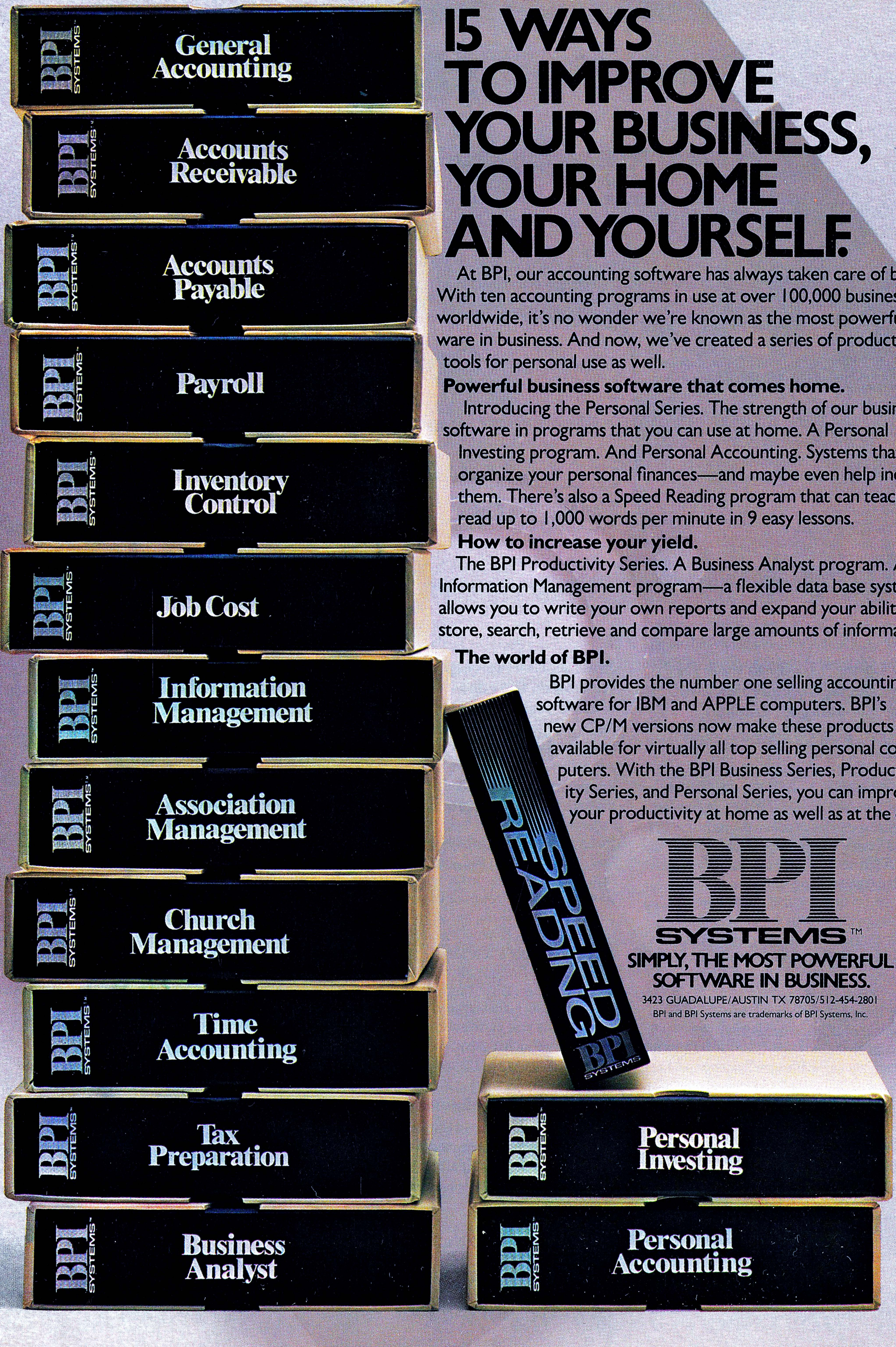
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ware developers running PC-DOS or CP/M-86. It includes a full-screen text editor, the C88 compiler, an assembler, a linker, a librarian, and various utility and demonstration programs. All are written in C, with a few assembler support routines. The distribution kit includes twenty files, one hundred pages of documentation, a form for reporting errors or problems, and a newsletter.

The editor is called See. It looks and behaves a lot like the *Select* editor, without the latter's word processing component. Besides the usual insert and exchange modes, See allows block moves, forward and backward search and replace, string list, and string replace. Files may be inserted into the text work area, and blocks of text may be written to external files. You can assign as many as four tags to positions within the text buffer and jump to these directly. Tab settings, indent mode, and auto-insert mode may all be set and reset dynamically, although they cannot be saved at the end of an edit session. Many commands permit a repetition count. Cut-and-paste operations are permitted across files. There's no limit to input line length. Long lines do not wrap around on the screen; they cause the screen to scroll horizontally.

The *macro* command allows you to define one macro (2,000 bytes maximum) for function key F1. Unfortunately, you can't save macro assignments permanently. The *quit* command comes with several nice options. You can exit saving the new file only, or you can save the new file and rename the old one to Filename.bak—just like in Edlin. The update option writes the whole text buffer to the output file designated at startup, while the write option writes it to a designated file. At any time, you can monitor the memory used and available. See cannot handle files larger than available memory. The initialize option allows you to clear the text buffer and reload a new file without reloading See. You're prohibited from accidentally erasing the text buffer by quitting without saving.

See makes excellent use of the special keypad keys. Home and end put you at the start and end of the current line, the arrow keys manipulate the cursor, and the page-up and page-down keys do as their names suggest. Other control characters are also used. In short, See is a delight to use.

The C88 compiler was designed for the Intel 8086 and 8088 processors and compiles programs that conform to the aforementioned Kernighan and Ritchie definition of the language—with the following restrictions and exceptions: Data type *char* is an unsigned byte with values 0 through 255, rather than −128 through 127. The *int* and unsigned types use sixteen bits, while *long* uses thirty-two. *Float* and *double* use four and eight bytes respectively. Pointers are sixteen bits, and therefore the total data space is limited to 64K. Unix version 7 extensions and version 6 obsolete constructs are not supported. Include files can be nested three-deep, and structure tags must be defined before being referenced. One exception is that structures may contain pointers that reference as-yet-undefined structures. Extensions include thirty-one-character variable names and support for in-line assembly code via *#asm*.

C88 is a two-pass compiler. By default it generates assembly code and automatically loads the assembler as an overlay to generate object code. The intermediate assembler source file can be saved, although the C source code is not included in it as comments. You can put the code-generation and assembler overlays and the temporary work files on separate drives as a way of improving performance. You can also specify the drive on which the *#include* files reside; that's a particularly nice feature, since it eliminates the need to hard-code drive specifiers.

After each compilation, C88 generates several handy statistics. The number of warnings and errors (if any) is displayed, along with the amount of code and data generated (specified as a hexadecimal number of bytes). C88 also

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gives a percentage utilization figure that tells you how close the compiler is to its limits.

C88 errors come in four flavors: fatal, syntax, warnings, and errors detected by the assembler overlay. Fatal errors cause the compiler to quit. Errors are printed in the following format:

```
    23 if (i < 99 $$ {
         error:Need ()
```

The number preceding the source line is the source file line number, as seen in a CLIST-generated listing or by Edlin. The $$ shows how far the compiler got before it found the error. This format—and the meaningful error messages—usually makes it easy for you to find the source of errors.

C88 generates assembly code that's incompatible with the IBM *Macro Assembler*. The DeSmet assembler, called ASM88, is similar to Intel's ASM86 but has been simplified. The assembler was written as the third pass of the compiler and was not originally intended to be a standalone program. Like C88, it lets you put temporary files on specific drives. Code-generation and data-generation figures indicate the free space in the assembler's symbol table.

ASM88 generates object code that's incompatible with the DOS linker, but a linker called Bind is provided. Bind links separately compiled or assembled modules with library modules, to form executable programs. Bind automatically searches the library file CSTDIO.S for any undefined globals. Two libraries are provided, one containing floating-point emulation code and other 8087 coprocessor support. The user renames the appropriate one to the expected default library name.

Bind allows several options. Globals and their offsets may be listed in sorted order by name. By default, the stack is made as large as possible, although the user may fix it at a specific size. The default library drive may be named. Code and data generation and percent utilization are displayed. An estimate of the runtime stack and local variable space is also provided. Bind can handle a maximum of two hundred code modules.

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The libraries include many routines similar to those available with Unix systems and are callable by both C and assembler routines. Detailed examples of their use are documented. Version 2.1 of the DeSmet C system added a quicksort, as well as transcendental, square root, and random number routines. A large number of routines have been written specifically for the PC. These are provided in assembly source code format and can be linked with other C and assembly code. These routines include screen and cursor control and several special I/O features.

Version 2.2 added the facility to execute or chain to DOS external programs, as provided by DOS 2.0. The exit function now accepts an argument value of 0 through 255, which can be tested by an *if errorlevel* statement in a DOS 2.0 batch file. The compiler, assembler, linker, and librarian also return completion codes that allow users better control over batch processing. A new utility, called Later, provides a rough-and-ready equivalent to the Unix Make program.

LIB88 is a crude object-module librarian. The only option available is library creation. The user cannot add to, delete from, replace, or list library modules. Modules must be placed in the library in a specific order if one module calls another. In short, LIB88 is of limited use.

CLIST is a utility that formats C source files into a line-numbered, paginated listing complete with cross-references. *#include* files referenced in source programs are not listed with those programs. The page length, line width, and tab expansion size can all be set at usage time. Besides providing a nicely formatted listing, CLIST can be used to identify source code lines referenced in errors found by C88.

Under DOS 1.1, CLIST requires more than 64K. Presumably this is because it sets up a large symbol table for cross-reference purposes. All other programs in the package run nicely in 64K under DOS 1.1. Fortunately, if you're working with a 64K system, you can just use the *jump #* command within See or Edlin to find source lines in error.

Two header files are provided: STDIO.H, which contains a few commonly used *#define* commands and assignments for *stdin*, *stdout*, and *stderr*, and MATH.H, which defines several math library modules as double.

The package also includes a RAM disk driver program, which can use anywhere from 32K to 650K. This facility is available only in DOS 2.0. BUF128.COM modifies DOS to allow a 128-byte typeahead buffer. This is most convenient in program development, where lengthy commands are often stacked up. Assembler source code is provided.

An ASCII and hex file-dump utility is also included, along with C source code, as is the game of *Life*. A final bonus is the game program *Bugs!*. This is a reasonable imitation of the arcade game *Centipede*, without the intimidating sound effects.

The executable and library files require approximately 200K of disk space. When the source, object, and temporary files are included, it's obvious that a second drive or RAM disk is needed. None of the development utilities requires or uses the color/graphics adapter.

The documentation is complete and readable.

The C *⋆newsletter* is published on an ad hoc basis; currently its release coincides with new product upgrades and releases. It is the main vehicle for dissemination of product status information. Besides listing fixed and outstanding bugs, it discusses operating-system compatibility issues, library enhancements and changes, and other matters.

The DeSmet C Development System has been professionally designed and packaged. It is aimed at professional software developers and should be widely accepted by them. The company's approach to marketing and distribution is basic—no fancy stuff, just good solid usable software. Many of the utility programs are worth the total package price. Although the assembler source code and object module formats are not DOS standard, the package represents excellent value for the money. ▲

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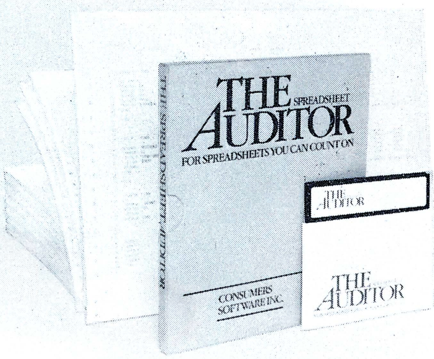

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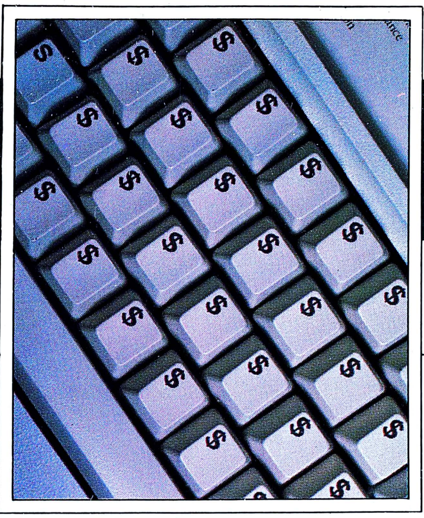

MICRO FINANCE

by Ken Landis

Money Track

This month we're going to look at a general-purpose accounting system called *Money Track*, from Pacific Data Systems. As the name implies, this program helps you organize your financial life, keeping track of where your money comes from and where it goes.

Money Track is a reasonably flexible integrated accounting system. The program maintains a set of books in a manner very similar to, if not exactly the same as, most general ledger packages.

On the balance sheet side, it records and stores assets, liabilities, and equities. On the income statement side, it stores and records income and expense items. The program also cuts checks. What makes *Money Track* valuable, however, is not its ability to record information so much as its ability to analyze it—its ability to go through your records, sort them, sum them, and produce reports from them.

What we have here is for all intents and purposes a general ledger system (with basic accounts receivable and accounts payable functions) that doesn't want to appear like one. Why doesn't it? Because most people find accounting (not to mention accountants) boring. By "cloaking" its accounting-system nature, the *Money Track* authors perhaps are trying to broaden the appeal of their package.

Your first encounter with *Money Track* may be a little disconcerting. The program takes an inordinate amount of time to load. Moreover, once loaded, *Money Track* asks some rather impertinent questions. It wants to know your program license number (printed on the registration form) and your computer's serial number.

After you've submitted to that interrogation (if indeed you have), *Money Track* forces you to make a backup copy of the program disk. In fact, any time you ever boot the original program disk, you're asked if you really want to be messing around with the original.

The first thing you do in *Money Track* (after making your obligatory backup) is build a chart of accounts. This, as the name implies, is a list of the various accounts you'll be using to record your transactions. *Money Track* handles accounts in three major categories: funds, businesses, and what it calls merely "accounts."

Funds are bank accounts, savings accounts, brokerage accounts, or money market accounts. *Money Track* organizes fund accounts according to their ownership. If the funds belong to an individual, family, or any other nonlegal business entity, *Money Track* calls them "general funds"; funds that belong to proprietorship, partnership, or corporation are classified as business funds. The program allows for up to sixty general funds and as many as forty business funds.

Money Track recognizes two kinds of businesses: legal entities and nonlegal entities. The former category encompasses what you'd normally think of as a business—a sole proprietorship, a partnership, or a corporation. The nonlegal category includes enterprises, investments, or areas of personal interest (stamp collecting, for example). *Money Track* can handle up to thirty legal entities and up to seventy

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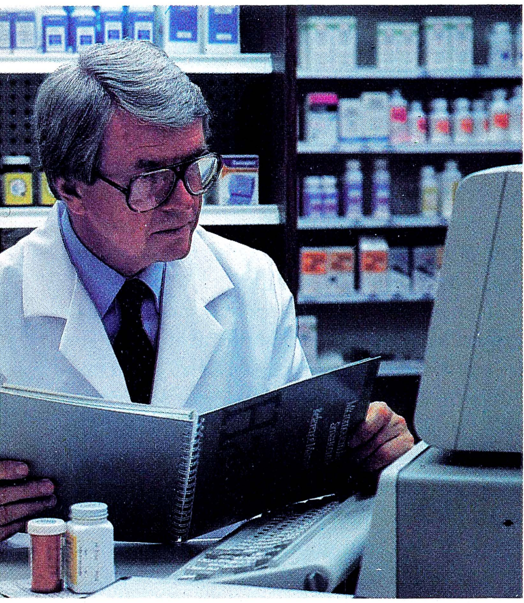

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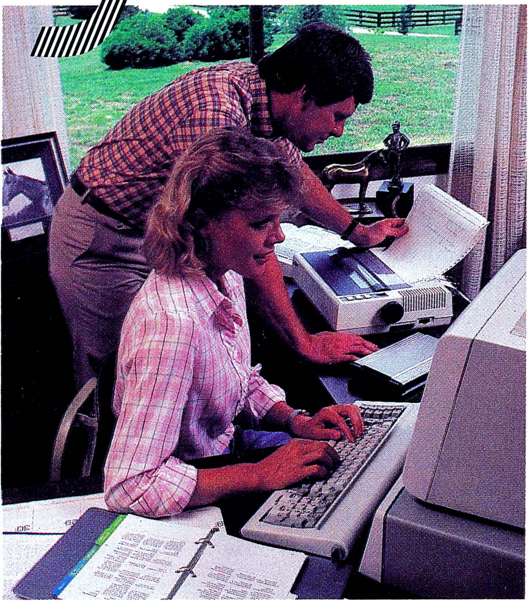
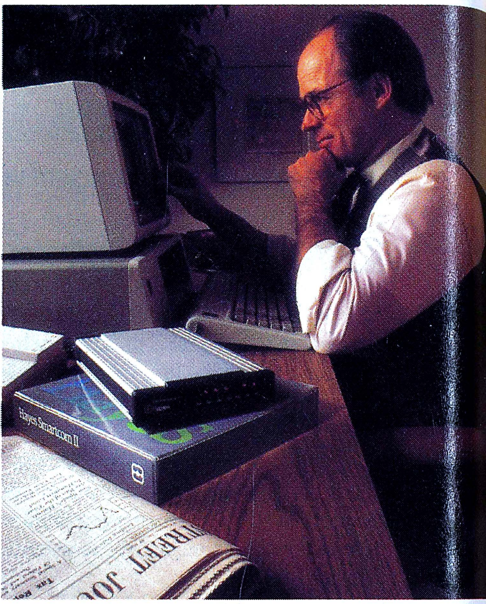


Gary: The pedigrees for next week's auction are as follows...



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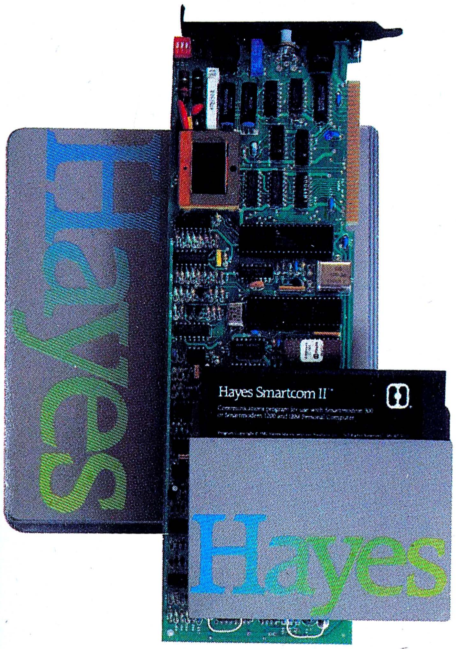

Smartcom II communications software.

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nonlegal ones. The legal entities use only business funds, while nonlegal entities use general funds.

"Accounts" in *Money Track* are basically the same as accounts used in any general ledger—that is, they are categorized as assets, liabilities, income, expenses, and equity. All businesses on *Money Track* share the same set of accounts. This sharing convention allows *Money Track* to produce consolidated reports as well as reports by individual businesses.

Money Track can handle 300 asset accounts, 200 liabilities, 100 income items, 100 expense items, and thirty business equity accounts.

From the structure of its chart of accounts, you can see that *Money Track* will handle not only personal finances, but the finances of a small business as well. The program works well for real estate partnerships, investment trusts or funds, or trustee accounting.

From a strict accounting perspective, funds are considered assets. *Money Track* breaks them out of the asset category. Presumably it does so in order to facilitate its transaction-by-business reporting capability. This is not a drawback, but you should be aware that these assets will not be listed as such on the chart of accounts or in reports; they'll be listed as funds.

Once you've established your chart of accounts, *Money Track* is ready to start monitoring your financial life. Transactions you enter into the program are classified in five ways: fund increases, fund decreases, transfers, journals, and balances forward.

An increase in a fund represents an overall positive change in the value of that account. For example, if the fund is a checking account, an increase might come from a deposit. Other fund accounts would increase for similar reasons. A decrease represents a withdrawal from the fund—a check drawn against a checking account, for example.

A transfer moves monies from one account to another. An example of a transfer transaction would be a shifting of money from a disbursement account (checking, for example) to an investment account (such as savings).

A journal entry moves monies from one business or account to another. Journal entries follow the format for standard double-entry bookkeeping. One account is charged with a credit while the other is charged with a debit. Journal transactions do not involve a fund. An example of a journal transaction would be a decrease in the value of a building through depreciation (credit entry) and a corresponding increase in the building's accumulated depreciation (debit entry).

Balance forward transactions are used to set up initial balances for funds and businesses. They're also used to establish the balances used to open a new fiscal year's books.

The transaction routines in *Money Track* are very well done. They're pleasing to the eye and have a few features that greatly enhance their functionality. For example, if you have repetitive transactions (such as mortgage or other loan payments), you can use the *repeat transaction record* command to create a copy of a transaction already on file. A *display transaction* feature lets you look at a transaction record but not change it; this prevents you from accidentally changing or copying the information.

At any time during the transaction-entry procedure, during an edit session, or during a repeat sequence, you can interrupt the program and get a list of the chart of accounts. If you have established a fairly lengthy, complicated chart of accounts, you'll find this feature handy. Most people can remember the account numbers of their more commonly used accounts—but not the whole chart. All you have to do to get the listing is hit a 0 instead of an account number; the program immediately displays the possible account numbers for the entry in question.

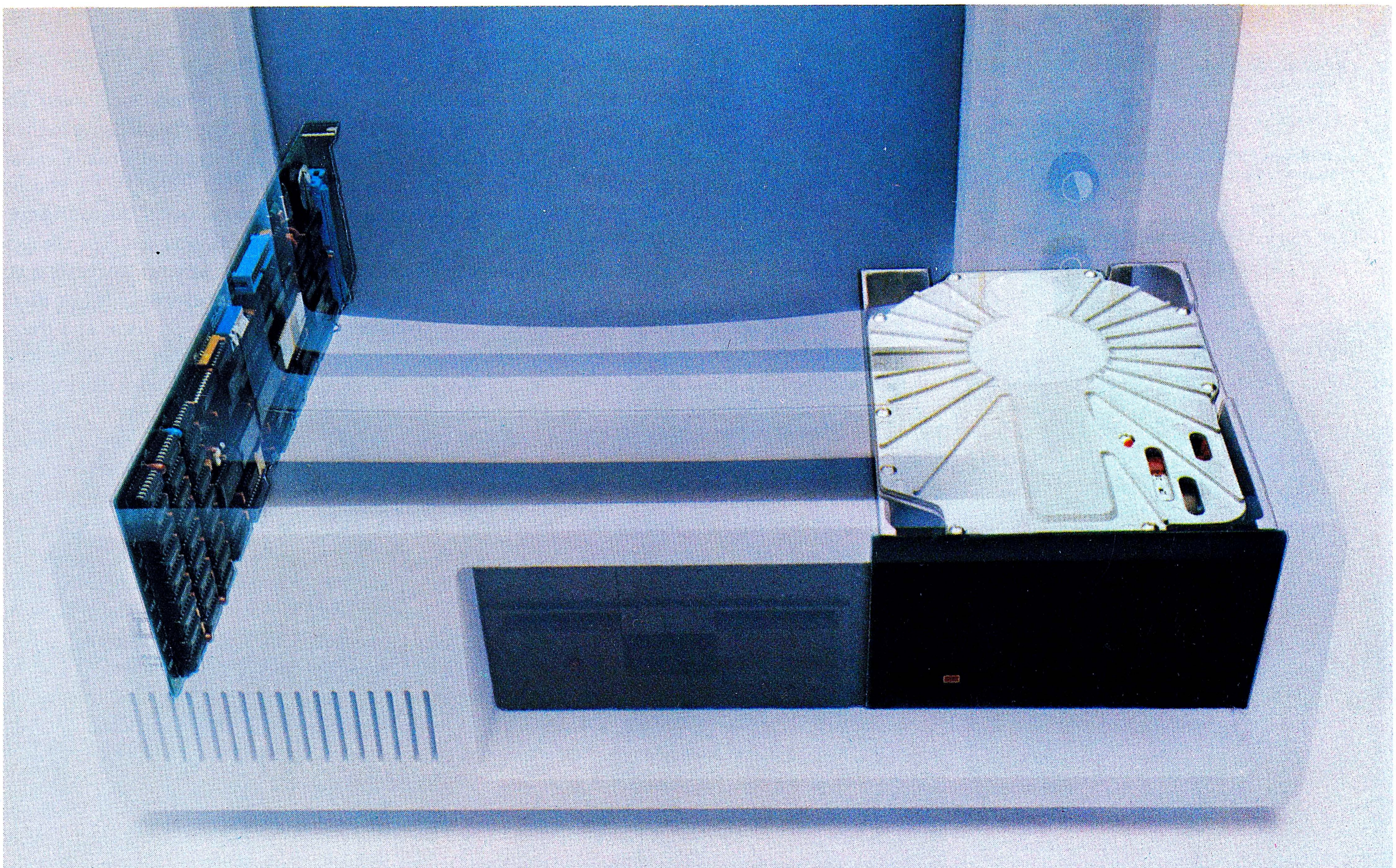
Furthermore, when you enter an account number in a transaction entry screen, *Money Track* automatically displays the name of that account. If the name doesn't match the account you intended to post monies to, you can replace the account number with a 0 and summon the list again.

The *repeat transaction* feature allows you to specify the frequency of repetition. *Money Track* handles two kinds of repeaters: monthly transactions and quarterly ones.

The program also allows you to record multiple-distribution transactions—such as credit card or mortgage payments. These are transactions in which part of the amount spent (or received) must be posted to one account and part to another. (Loan payments, for example, generally consist of a principal component and an interest component). *Money Track* allows you to post a transaction to as many as eighteen separate accounts. This feature greatly enhances the value of the program as a tax-record-keeping system.

One of the major problems inherent in any automated record-keeping system is correction or adjustment of entries—in other words, editing. *Money Track* makes editing easy. The program gives you a choice of editing prior entries or recording offsetting entries.

Money Track's data-entry procedure is simple and pleasant to use. You can move your cursor to any point on the screen at any time. Date entry, which on some programs is a chore, is simplified by the fact that you only have to enter numbers; *Money Track* supplies the slashes. The program also checks dates to see if they're reasonable; if you try to record a transaction dated two months later than your



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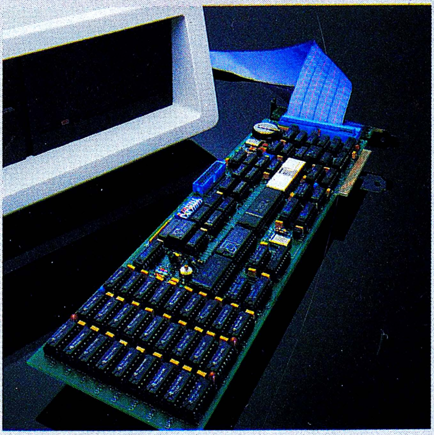

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last recorded item, or if you enter a business date more than a year away from your last one, *Money Track* will ask you to check your information. Other numeric entries are just as easy and as well error-checked.

Reports produced by *Money Track* include a list by business/account, a list for selected business/accounts, a list for selected accounts, balances by business or account, a list by funds, balances by fund, a list of repeating items, and an audit trail. Any of these reports can be viewed on-screen or sent to the printer.

With any of these reports, you can specify beginning and ending dates, as well as the businesses or accounts to be included. A new business or account automatically starts a new report page, so you won't have to search for the end of one report and the beginning of another.

Accounts are grouped in the reports by type—assets, liabilities, and so forth. When all the accounts of a type have been printed, *Money Track* records the total gross and net dollars charged or credited for that account type.

A short recap is printed for each business/category. The profit-and-loss recap shows income, expense, and net profit or loss. The balance sheet summary shows the net change in the balance sheet accounts, the net profit or loss, and the net balances forward from any balance sheet item.

Transaction lists by selected business accounts are ordered according to the date supplied when the transactions were entered. Gross credit and debit totals are calculated and displayed at the bottom of the report.

A good many other reports are offered as well. Probably the most important, in terms of establishing *Money Track*'s credibility with accountants, bookkeepers, or the Internal Revenue Service, is the entry audit report. This is a detailed record of every transaction ever entered into the program. Transactions are listed in the sequence in which they were entered, so finding a given day's, week's, or month's data is simple. Transactions that have been modified by the user are labeled "MOD" in the report; multiple-distribution transactions are marked with a #.

In addition to the five standard transaction types, *Money Track* can handle investment transactions in stocks (both long and short), bought calls and puts, sold calls, and bonds. All the necessary information is entered into a business in the chart of accounts item called Securities. The transactions can be entered directly or via a brokerage money market account, if that is the way you personally handle your securities transactions.

Money Track will print checks for properly qualified decrease fund transactions. A qualified transaction is one that had a −1 entered into the document number field at the time of data entry. *Money Track* scans the transaction file and prints checks for any record in the fund entered by the user with this characteristic.

When the first potential check is displayed, the user is prompted to enter the last four digits of the check number in the print-checks screen. This control number is used for auditing purposes. On subsequent checks, this number is automatically incremented.

After each check is printed, the program asks you to confirm that the check was printed satisfactorily. If your answer is affirmative, the −1 in the document-number field is changed to the four-digit control number you entered. If not, the entire procedure is repeated. *Money Track* lets you store up to nine customized check formats.

The program also has a feature to help you reconcile statements from banks, brokers, and so on. Up to 500 open items can be handled. The fund reconciliation module has full reporting capabilities and, like every other aspect of the program, is well thought out. The program even allows for reconciliation of checks after the close of the fiscal year (the program will consult the previous year's data disk, if necessary).

Money Track's capabilities are impressive. The program runs a little slowly, but given the functionality it provides, this seems like a tolerable fault. On the whole, the program is a masterwork of foresight and practicality. It also appears to be bug-free. ▲

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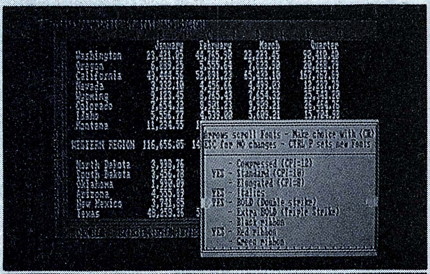
What are they offering in return for your effort? The *Softalk* reader who submits what Photon thinks is the best name for its new software package will win a PC*jr* complete with disk drive, Zenith monitor, DOS 2.1, and Basic. All you need to do to win the PC*jr* is think of a name for Photon's new software package.



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YES - Italics
YES - BOLD (Double strike)
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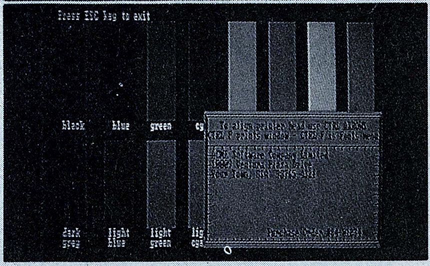

Press ESC key to exit

Here's Photon's description of the unnamed software:

"This product will give microcomputer users an instant window through which to access their printers any time they desire. In the middle of any other program or application, one key will open a window on the user's screen. Once the window is open there are three general types of functions that may be performed. Once the printer functions have been completed, one key will instantly close the window and return the user to the original application.

"The following are descriptions of the three types of functions available once the product has been turned on:

"1. Using simple word-processor-like commands, the user will be able to compose a short text (such as an address label or Rolodex card). The user can then place the physical envelope, check, paper sheet, index card, or Rolodex card in the printer. Using the cursor arrows on the ten-key pad area of the keyboard, the user may then position the print head in exactly the position desired on the envelope, check, etc., where the text should be printed. One keystroke will then print out the short text, exactly where the user desires.

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Three runners-up for best name will receive a package containing already-named Photon software (*Tenkey* and *Media Magician*), The Unnamed Product, and a Photon binder. This prize also will be awarded to those readers who come up with the best acronym, the most humorous name, and the worst name.

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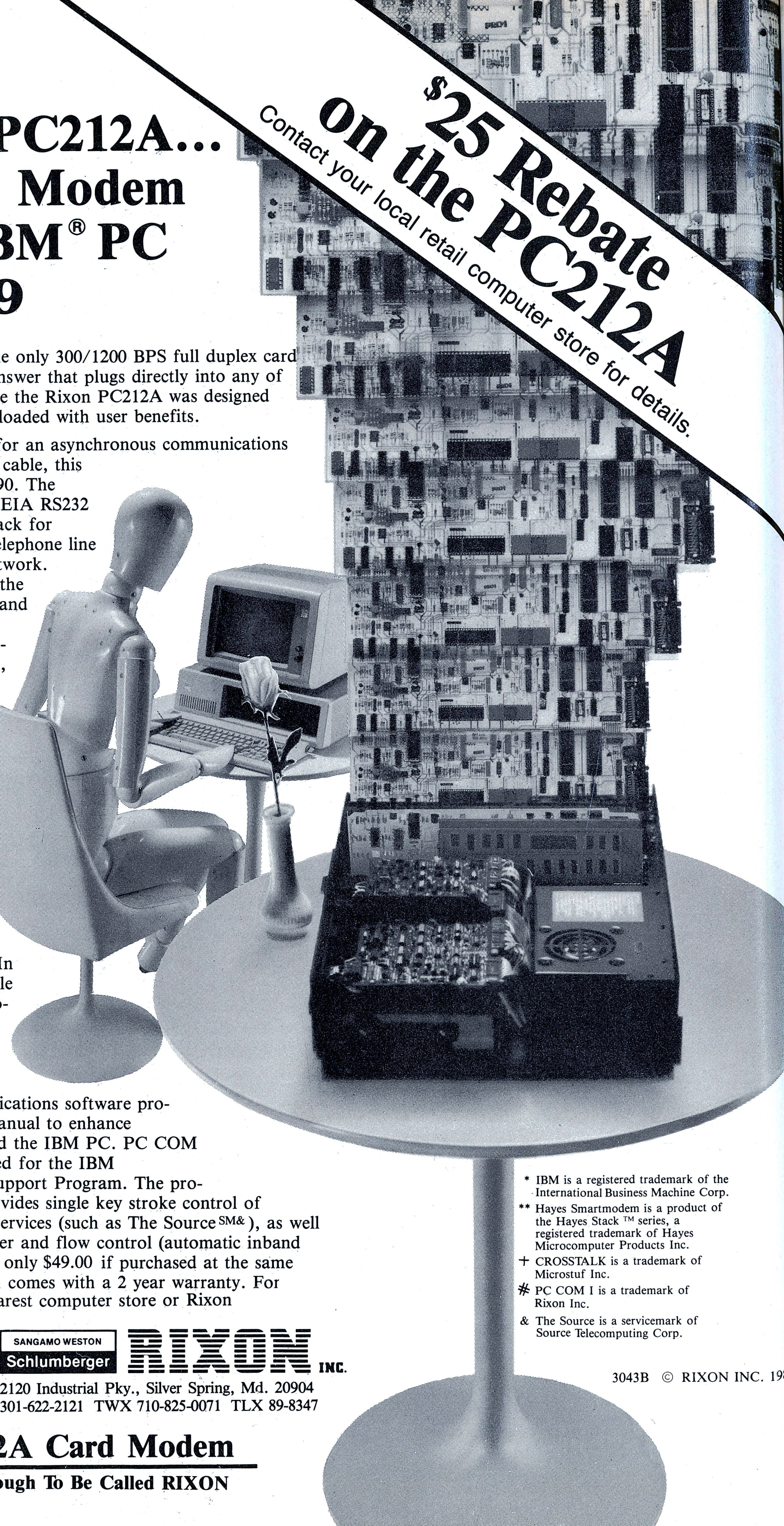

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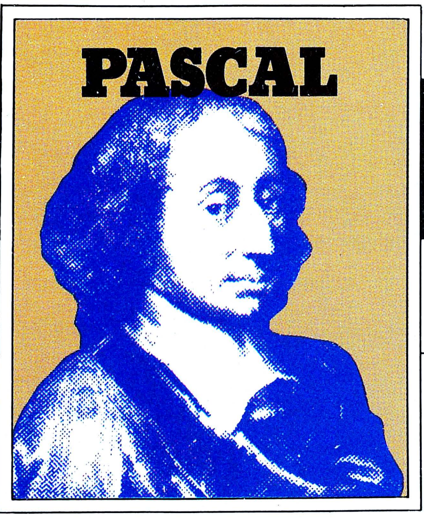

FROM BEGIN TO END

by Bruce Webster and Deirdre Wendt

A Review of Turbo Pascal

Many of you have seen the ads for Turbo Pascal (from Borland International) here and elsewhere. Come on (you may have said)! A Pascal compiler that takes up only 33K, compiles programs in seconds, and costs only $49.95? There's gotta be a catch.

There isn't. Turbo Pascal is for real.

One could understand a smaller Pascal (although 33K, with the editor, is a little hard to understand); one could accept a faster-working Pascal. It's not impossible to believe in a Pascal that produces smaller and faster code. But all three at once is a little hard to take. Turbo Pascal appears to violate the laws of thermodynamics.

It works, moreover. So far we've encountered only one bug (which Borland promises to fix). It's as good and as fast as they say it is. You won't find a comparable price/performance package anywhere.

The Implementation

Turbo Pascal (unlike some other inexpensive Pascals) is pretty much a complete Standard Pascal. Most of the differences between it and Standard Pascal are found in other implementations as well. For example, as in UCSD Pascal, the procedures *new*, *mark*, and *dispose* are used for dynamic variables, and procedures and functions cannot be passed as parameters.

The only significant variation from Standard Pascal is that the procedures *get* and *put* are not implemented. Instead, *read* and *write* are used for all types of files, not just text files. This means that a file buffer isn't automatically allocated for each file defined, saving (says Borland) both time and memory space. This difference takes a little getting used to, but it works just fine.

While meeting most of the Standard Pascal criteria, Turbo Pascal also has many extensions, most of which will warm the cockles of any programmer's heart. Here's a summary:

Strings. Strings are handled a la UCSD Pascal and Pascal/MT+. All the string procedures and functions are handled, along with a few improvements (*str* converts from both integer and real to string); there's also a new procedure, *val*, that converts from string to either integer or real.

The aforementioned bug involves string comparisons. If you have two strings, and one is a substring of the start of the other ('ab' and 'abc' or 'Bob' and 'Bob Trammel', for example), a less-than comparison ('ab' < 'abc', 'abc' < 'ab') will always return *false*. Philippe Kahn, president of Borland International, assures us this problem is being fixed. If you have Turbo Pascal and are writing a program involving string comparisons, you might want to watch for this and perhaps write a special comparison routine.

Bit-and-Byte Operations. Some of Turbo Pascal's niftiest extensions involve bit-level operations on integer values (two-byte quantities between −32768 and 32767). The operators *not*, *or*, *xor*, and *and* all work with integers, and two new operators, *shl* and *shr*, allow you to shift integer values left and right a specified number of bits. The procedures *hi* and *lo* return the upper and lower bytes of an integer, while *swap* exchanges the upper and lower bytes.

Memory Operations. The *addr* function returns the address of any variable, procedure, or function. The address is returned as a thirty-two-bit pointer value. You can also use *ofs* and *seg* to get the offset and segment values (as integers) of the address of any variable, and so on. The functions *cseg*, *dseg*, and *sseg* return the base address (integer) of the code, data, and stack segments respectively. And, you can force a variable to be created at a specific address by using the keyword *absolute*, followed by the segment and offset values:

```
VAR
  something      : integer ABSOLUTE $0000:$01F0;
  otherthing     : string[40] ABSOLUTE dseg:$00A0;
  otherlength    : byte ABSOLUTE dseg:otherthing;
```

(Incidentally, the *$xxxx* notation allows you to define hexadecimal constants.) The variable *something* is declared as being in segment 0 with an offset of $01F0. The string *otherthing* is placed in the data segment with an offset of $00A0, and *otherlength* has the same address as the first byte of *otherthing*.

Here are a few more goodies. The predefined arrays *mem* and *memw* allow you to read from and write to memory directly, either a byte or a word (integer) at a time. The format is *mem[segment:offset]*. So you can do the following:

```
VAR
  bval           : byte;
  wval           : integer;
  something      : integer;
BEGIN
  bval       :=mem[$0005:$0A00];
  wval       :=1999;
  memw[seg(something):ofs(something)] := wval;
END.
```

Note that the last statement is equivalent to *something := wval*. Two similar arrays, *port* and *portw*, allow direct access to the I/O ports (*bval := port[$0A]*).

Machine-Level Operations. Turbo Pascal offers three ways of doing machine-level operations. First, you can make calls directly to MS-DOS or CP/M-86. Second, you can insert machine code directly inline anywhere in your program using the *inline* statement, which takes the form

```
inline(⟨byte⟩,⟨byte⟩,...);
```

Finally, you can create your own assembly language procedures (using your own assembler; none is currently provided) and then declare them as being *external* to your program. They will be read in and linked at compilation time. Since your assembly won't know where they will be inserted, these routines must be relocatable, must not reference the data segment, and must save and restore certain registers.

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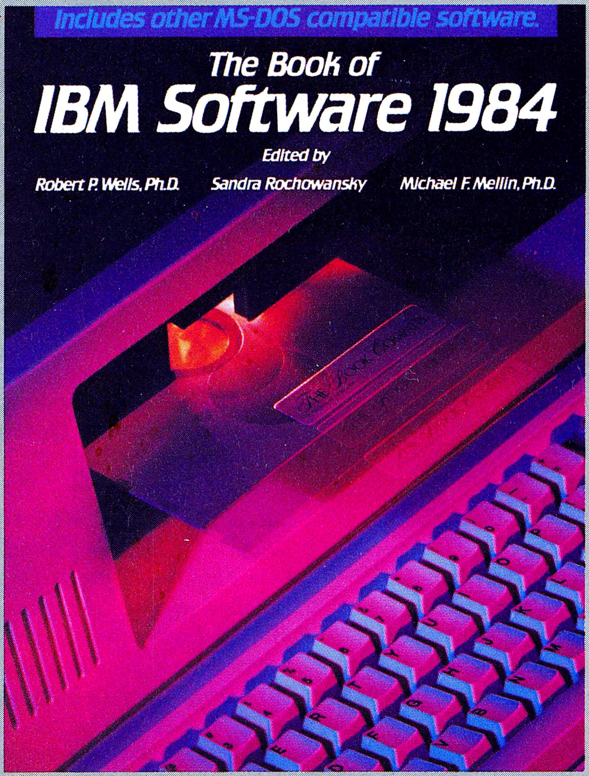
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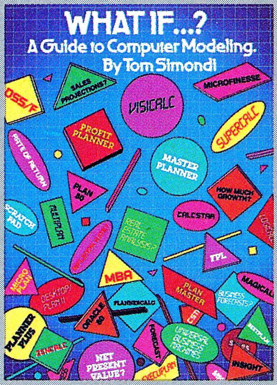
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Screen Procedures. Turbo Pascal comes with some built-in screen control procedures. These make it easy to write screen-oriented programs. Here's the list:

gotoxy(x,y)	moves to any location on the screen
lowvideo	all characters written will be "dim"
highvideo	all characters written will be "bright"
clrscr	clears the screen
clreol	erases to end of line
delline	deletes line and moves everything below up
insline	inserts line and moves everything below down

Other Odds and Ends. There are some other extensions, implementation aspects, and built-in procedures. Some of the extensions include:

- free mixing of CONST, TYPE, and VAR sections;
- structured constants (arrays, records, and so on) that can be used as preinitialized variables;
- an *else* clause in *case* statements;
- untyped files with *blockread* and *blockwrite* procedures;
- random-access files with the *seek* procedure;
- six-byte reals, yielding eleven significant decimal digits and an exponent range from −38 to +38.

One particularly nice implementation aspect is heap and memory management. When you compile a program in Turbo Pascal, it sizes memory and allocates all that the program itself doesn't use for the heap. This means, for example, that on a 256K machine, many programs will have more than 200K of heap space. That's room for a lot of dynamic variables.

Another implementation feature has to do with very large programs. Since the code files produced by Turbo Pascal are .com files, your code can be 64K at most. What if you have a larger program? Turbo has a simple mechanism for chaining between programs. Information passing is done by matching definitions of global variables. Since the runtime library remains resident, files that you chain to (these have the extension .chn) are smaller by about 10K.

Yet another interesting implementation feature involves predefined device files. Standard Pascal defines the files *input* and *output*; these are of type *text* and are used by default in any *read* or *write* statements. Turbo Pascal has several additional predefined files that you can use without having to do a *reset* or *rewrite*. Here they are, along with the devices to which they're assigned:

con	CON: (same as default input and output)
trm	TRM: terminal device (nonbuffered input)
kbd	KBD: keyboard (immediate, nonechoed input)
lst	LST: printer (output only)
aux	AUX: serial device
usr	USR: serial device

You can also write your own device drivers and assign them to the *con, lst, aux,* or *usr* files.

Finally, there are many built-in procedures and functions for your delight and edification. These include:

frac	returns fractional portion of real number
fillchar	fills location with value
move	copies from one location to another
halt	stops program
keypressed	check for pressed key
randomize	initializes pseudo-random number routine
random	returns random value

In short, Turbo Pascal is one of the most complete Pascals on the market.

The Development Environment

To run Turbo Pascal, you simply type *turbo* and go to work. Your options include compiling a program that's on disk, pulling in a program for editing, and creating a brand-new program. You can also indicate whether you want your code file to go to RAM or to disk. The fastest compile times are achieved by compiling to RAM a program that has

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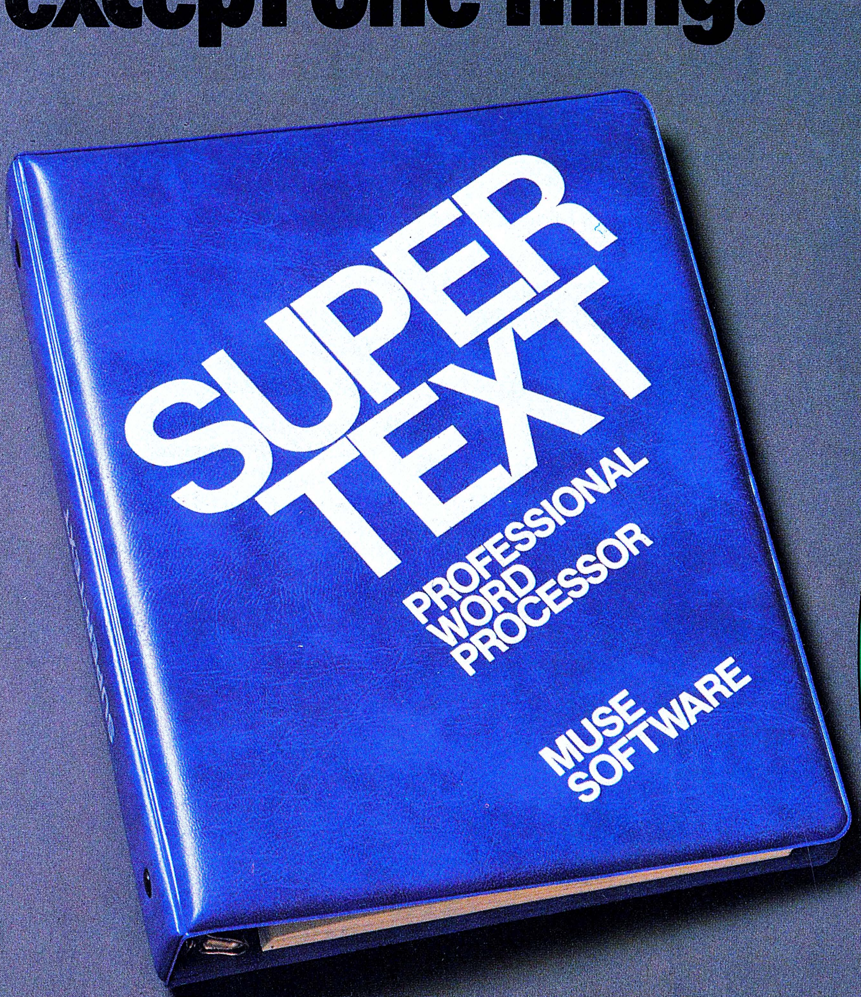

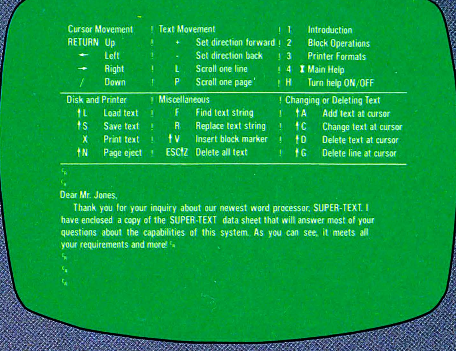

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RETURN  Up        !    +   Set direction forward ! 2    Block Operations
  ←     Left      !    -   Set direction back  ! 3    Printer Formats
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  /     Down      !    P   Scroll one page     ! H    Turn help ON/OFF
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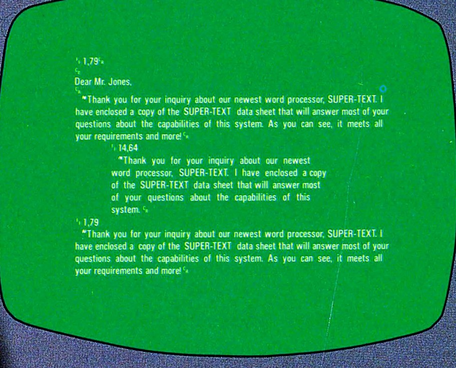
  ↑L    Load text   !    F   Find text string     !   ↑A   Add text at cursor
  ↑S    Save text   !    R   Replace text string  !   ↑C   Change text at cursor
   X    Print text  !   ↑V   Insert block marker  !   ↑D   Delete text at cursor
  ↑N    Page eject  ! ESC↑Z  Delete all text      !   ↑G   Delete line at cursor
-----------------------------------------------------------------------
␍
␍
Dear Mr. Jones,
   Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed a copy of the SUPER-TEXT data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
␍
␍
␍
```

ON-LINE "HELP"



```
1,79␍
␍
Dear Mr. Jones,
␍
  Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed a copy of the SUPER-TEXT data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
           14,64
             Thank you for your inquiry about our newest
           word processor, SUPER-TEXT. I have enclosed a copy
           of the SUPER-TEXT data sheet that will answer most
           of your questions about the capabilities of this
           system. ␍
1,79
  Thank you for your inquiry about our newest word processor, SUPER-TEXT. I
have enclosed a copy of the SUPER-TEXT data sheet that will answer most of your
questions about the capabilities of this system. As you can see, it meets all
your requirements and more! ␍
```

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already been loaded into RAM, since in that case there's no disk access. Disk-to-disk compiles go somewhat more slowly, although they're still blindingly fast by any other standards.

Turbo Pascal's built-in editor is initially configured to work like *WordStar*, but an installation program lets you change the commands to any sequence you prefer. When you're done editing, you exit from the editor, hit *C* (for *compile*), and zoom—your program is compiled. If there's an error during compilation, hit escape and you're immediately back in the editor at the line where the error occurred (and you get an explanatory message at the top of the screen).

Once your program is compiled, type *R* to run; when your program is finished, you're back in Turbo Pascal. If you get a runtime error (such as, say, a divide by zero), hit escape and you're back in the editor—at the line where the runtime error occurred. If a runtime error occurs while you're running a .com file, you'll get the address where the error has taken place. You can then run Turbo Pascal, load the work file, and ask it to find that address. Once again, you find yourself at the statement where the error cropped up.

Since the compiler doesn't produce listings (that's one reason it's so fast), the Turbo Pascal package includes a separate program (Tlist.com) for generating them. You can insert several different dot commands (similar to those used by *WordStar*) in your source code for printing purposes. In fact, you can actually use the Turbo Pascal editor and Tlist to edit and print documents other than programs.

Benchmarks

It's been said that there are three types of lies: lies, damned lies, and benchmarks. Like statistics, properly chosen benchmarks can be made to prove about anything you want to prove. So take the following for what it's worth—and no more. We used four benchmarks in testing out Turbo Pascal against other PC Pascal implementations: a prime-number generator, two versions of a matrix-multiplier, and a string-sort routine. For each benchmark, seven tests (from four implementations) were made: Turbo Pascal, Pascal/MT+, IBM Pascal, and UCSD Pascal (IBM and NCI, p-code and native code). Figures 1 through 4 show the results of these tests.

Data recorded for each test includes compile time and execution time (in seconds); for each of the first three tests, we also recorded the size of the executable code file. The Turbo Pascal compile times were all disk-to-disk; RAM-to-RAM development times would be much *faster*. Compile times for Pascal/MT+ and IBM Pascal include all passes and linking; they do *not* include time to exit from the editor, swap disks, enter filenames, or load the compiler/linker files. In other words, during actual development, Turbo Pascal would look even better. The execution times do *not* include the time for the file to load from disk.

The results are interesting indeed. First, Turbo Pascal beat everyone else cold in terms of compilation speed. The only other Pascal that came anywhere close is UCSD/NCI, and that was typically slower by factors of 4 to 5. It's hard to understand why Turbo can compile a program in six seconds, while IBM Pascal takes two minutes. Magic?

Code-file sizes are also telling. All four Turbo code files were less than 10K. Pascal/MT+ ranged from 10 to 17K, and IBM Pascal started at 25K and went up to 34K. So, the Turbo files were smaller in all cases.

Execution speeds varied wildly, showing some of the reasons why benchmarks can be misleading. For the first test, Pascal/MT+ was slightly faster (15.2 seconds versus 15.6) than Turbo Pascal, while IBM Pascal wasn't even close (76). The two p-code versions were very slow (183 and 263 seconds). The native code versions (a mixture of p-code and machine code) were both slightly faster than IBM Pascal (70 and 71 seconds).

The second benchmark showed quite a different result. This program initialized two 20-by-20 integer matrixes, multiplied them together into a 20-by-20 real matrix, then summed all the elements of the real matrix. Turbo Pascal (six-byte reals) was the clear winner (10.4 seconds), but second place went to the NCI p-code version (eight-byte reals, 23.5), while third place went to the NCI native-code version (24.2). (Note: sometimes, native code will be slower than straight p-code, because of the constant switching between p-code and machine code.) IBM Pascal (which has four-byte reals) was next at 33.6 seconds, while Pascal/MT+ (with eight-byte reals) ran at 39.4 seconds. UCSD came in last (49.4 and 57.3 for native and p-code respectively).

The third benchmark was just like the second, but with one key difference: The resulting matrix was integer instead of real, which meant that the multiplication was all integer (the summation was still real). Turbo still won, followed by MT+, NCI/native, NCI/p-code, UCSD/native, IBM Pascal, and UCSD/p-code.

The last benchmark used a brute-force bubble sort on an array of ten strings, sorting it ten times (for timing purposes). No math of any kind was done. Again, Turbo won, followed by IBM, MT+, UCSD/native, NCI/native, NCI/p-code, and UCSD/p-code.

Conclusions

So, now we have Turbo Pascal. It is cheap, fast, easy to use, full-featured and well-extended, and nearly bug-free. For another $100, you can license it for production purposes (for developing applications programs to market). It is, simply put, the best software deal to come along in a *long* time. If you have the slightest interest in Pascal, scrape up the $50 (which is far less than the $300 to $1,000 you'd spend on one of the other versions) and buy it. ▲

Compiler	Compilation	Code file	Execution
Turbo	4.8	9095	15.6
Pascal/MT+	85	10752	15.2
IBM Pascal	96	32768	76
UCSD/NCI/p-code	24	—	183
UCSD/NCI/native	47	—	70
UCSD/IBM/p-code	29	—	263
UCSD/IBM/native	62	—	71

Figure 1. Prime-number program.

Compiler	Compilation	Code file	Execution
Turbo	6.4	9674	10.4
Pascal/MT+	100	17408	39.4
IBM Pascal	129	34432	33.6
UCSD/NCI/p-code	30.3	—	23.5
UCSD/NCI/native	76	—	24.2
UCSD/IBM/p-code	35.9	—	57.3
UCSD/IBM/native	96	—	49.4

Figure 2. Matrix multiplication (version 1).

Compiler	Compilation	Code file	Execution
Turbo	6.2	9631	4.9
Pascal/MT+	97	17408	12.2
IBM Pascal	128	33536	23.3
UCSD/NCI/p-code	29.5	—	16.8
UCSD/NCI/native	74	—	15.0
UCSD/IBM/p-code	33.3	—	33.1
UCSD/IBM/native	92	—	22.1

Figure 3. Matrix multiplication (version 2).

Compiler	Compilation	Code file	Execution
Turbo	5.9	9679	12.3
Pascal/MT+	85	11264	14.4
IBM Pascal	108	25216	14.1
UCSD/NCI/p-code	25.7	—	20.2
UCSD/NCI/native	62	—	19.2
UCSD/IBM/p-code	35.0	—	31.2
UCSD/IBM/native	83	—	19.1

Figure 4. String sorting.

Would you believe that for $99 you could...

Move
"Mountains"
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"Straw" into "Gold"
Wipe Out
"War" and "Famine"
Locate
"Atlantis"
Copy
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Even Justify
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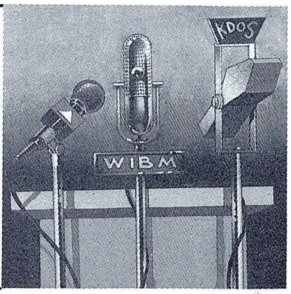


Unless otherwise indicated, software listed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

Δ **Gateway Microsystems Incorporated** (9501 Capitol of Texas Highway, Austin, Texas 78759; 512-345-7791) announces the *Microgate 742*, a Texas Instruments Model 742 terminal emulator that permits PCs to be placed into most 742 polling environments, often permitting 742s (and TI models 770, 771, and DS990 Model 1 terminals emulating the 742 protocol) to be replaced with PCs. $645.

Δ **Penton Software** (420 Lexington Avenue, New York, NY 10017; 212-878-9626) introduces *QualityAlert*, a statistical quality-control package that enables users to analyze process capability, construct eight different types of control charts, and determine when quality deviations occur. $795.

Δ *Pro/Pik*, available from **Software Strategies** (7412 Washington Avenue South, Eden Prairie, Minnesota 55344; 612-941-4044), is a "point spread" calculator for professional football scores. A user can forecast the spreads or differences between the winning and losing teams for up to twenty football teams at one time. $199.

Δ **FinCom** (1508 Cotner Avenue, Los Angeles, CA 90025; 213-478-0191) offers *CommTrader*, a commodity and futures quotation system that provides the user with a comprehensive visual display of futures quotations in a real-time environment using a data feed. It allows the selection of up to ninety-six individual futures contracts. Installation, $100. Monthly minimum lease, $100.

Δ The *PROPHIT I* financial-modeling system from **Via Computer** (7177 Construction Court, San Diego, CA 92121; 619-578-5356) is now available for the PC and XT as *Micro/PROPHIT*. The system allows users to develop model sizes of up to 9,000 by 135 columns. The modeling language contains more than seventy calculation methods and financial functions. Requires 192K. $695.

Δ You have been deserted in the midst of a trackless waste by your disgruntled native bearers. As an adventurer in search of a mysterious pyramid, your first priority is to find water, second, to find the pyramid. Such is the scenario in *Infidel*, the latest interactive prose adventure from **Infocom** (55 Wheeler Street, Cambridge, MA 02138; 800-463-6266). $49.95.

Δ *Pits and Stones*, a game usually played with little rocks in trackless wastes by the tribesmen who deserted you in *Infidel*, is now available in high-tech form from **Orion Software** (Box 2488, Auburn, AL 36831; 800-821-8088). The players' objective is to collect the most stones in their pits by strategically moving them in accordance with the rules of play. $36.95.

Δ A menu-driven statistical analysis system, *MathStat* allows direct data entry, accessing of data files created by popular database management systems, and reading of files downloaded from minis or mainframes. From **Mathematica Policy Research** (Box 2393, Princeton, NJ 08540; 609-799-2600). The package is capable of performing complex analyses on extremely large data sets. $500.

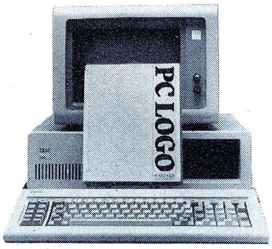
Δ The first of eleven modules in the Solomon III series of accounting software has been released by **Computech Group** (24160 Haggerty Road, Farmington Hills, MI 48024; 215-765-6666). The *Solomon III General Ledger* features graphic display of entries, help-key function, user-definable charts of accounts, consolidation of multidivisions or companies, and more. $595.

Δ **Enter Computer** (6867 Nancy Ridge Drive, San Diego, CA 92121; 619-450-0601) has unveiled the *Sweet-P Model 600 Six-Shooter*, a six-pen compact graphic plotter with a plotting speed of 14 ips, both RS-232 and parallel interfaces, nineteen English and foreign language character sets, and 2K of buffer memory storage. $1,095.

Δ *Jack2*, an integrated package that does word processing, spreadsheeting, charting, and database management tasks on the same screen at the same time without windows, is available from **Business Solutions** (60 East Main Street, Kings Park, NY 11754; 516-269-1120). $495.

Δ *Sales Planner*, a package designed to help sales professionals reduce paperwork, is available from **National Microware** (2102 Business Center, Irvine, CA 92715; 714-752-2344). The program is designed for use by nontypists. $295.

Δ **American Educational Computer** (2450 Embarcadero Way, Palo Alto, CA 94303; 415-494-2021) has developed a line of educational software designed to parallel the student's classroom experience. *Easy Reader* covers phonics, words, and reading comprehension. The series



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consists of eleven disks. $39.95 per disk. Δ *Matchmaker* covers vocabulary skills, grammar, U.S. geography, world geography, and Spanish I. Eleven disks. $39.95 per disk.

Δ Four peripheral products and additions to the IDEAdisk line from **IDEAssociates** (7 Oak Park Drive, Bedford, MA 01730; 617-275-4430): *IDEAgraph* is a high-speed, high-resolution graphics card available in 28-MHz and 40-MHz versions with 128K or 256K on-board. It is capable of generating sixteen colors at the standard PC resolution of 640-by-200 pixels. With 256K on-board, 256 colors are selectable from a palette of 4,096. $895—$1,995. Δ *IDEAComm 3278* emulates the IBM 3278 terminal and provides PC-to-mainframe coaxial communications via the IBM 3276 and/or 3274 controller. $1,195. Δ *IDEAshare* is a software product designed for resource sharing between four PCs or XTs within a 100-foot distance. $595. Δ *IDEAnet* is a combined hardware and software product that is designed for large-scale networking between twenty or more PCs. Hardware, $595. Software, $795.

Δ **Clarity Software Corporation** (11103 Spicewood Parkway, Austin, TX 78750; 512-258-5473) has announced the availability of *3-2-1 Go*, which converts *1-2-3* worksheets into models for mainframe and personal computer versions of the *Interactive Financial* programs. $2,000.

Δ *DunsPlus*, an integrated software/hardware/service package that includes the XT, *1-2-3*, *Multimate*, electronic mail, and public database access is available from **DunsPlus** (187 Danbury Road, Wilton, CT 06897; 203-762-2511). $10,200.

Δ **Broderbund Software** (17 Paul Drive, San Rafael, CA 94903; 415-479-1170) has released *Lode Runner*, an arcade-type game with more than one hundred fifty screens and a game-generating feature that allows players to create an unlimited number of screens. $34.95.

Δ **Context Management Systems** (23868 Hawthorne Boulevard, Torrance, CA 90505; 213-378-8277) has introduced *Corporate MBA*, a package that offers all the features of *Context MBA* but which has been rewritten to run in PC-DOS. The product also includes IBM 327X terminal emulation and 3270 communications protocols, a data-exchange facility enabling personal computers equipped with *Context MBA* to use text data and models produced by other software packages, such as *WordStar*, *VisiCalc*, or *dBase II*, and programmability that allows repetitive functions to be defined and captured as a set of keystrokes. $895.

Δ **Select Information Systems** (919 Sir Francis Drake Boulevard, Kentfield, CA 94904; 415-459-4003) has announced a word processor in a book. *Select Write* will be packaged like a bestselling novel and is aimed at novice users. $99.

Δ The *PC Connection* from **Point 4 Data Corporation** (2569 McCabe Way, Irvine, CA 92714; 714-863-1111) enables a PC to operate using MS-DOS in conjunction with any multiuser computer that employs the IRIS operating system. $550.

Δ The *Turbo-186*, a board designed to increase the speed and performance of a PC or XT, is available from **Orchid Technology** (47790 Westinghouse Drive, Fremont, CA 94539; 415-490-8586). Depending on the program being run, the board increases the speed of the PC from three to ten times. $995.

Δ *The Management Edge* is a program designed to improve management skills by developing a problem-solving strategy tailored to the personalities of the superior/subordinate/peer triad and to the culture of the work environment. From **Human Edge Software Corporation** (2445 Faber Place, Palo Alto, CA 94303; 415-493-1593). $250.

Δ *Household-Inventory-Track-I* is a menu-driven program to keep track of household items. It can also be used by small businesses to keep control of inventory and fixed assets. From **Sapana Micro Software** (1305 South Rose, Pittsburg, KS 66762; 316-231-5023). $49.95.

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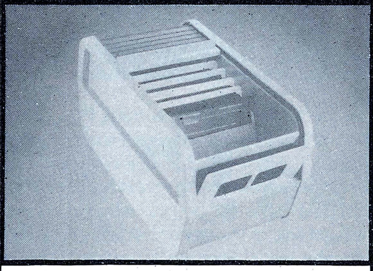

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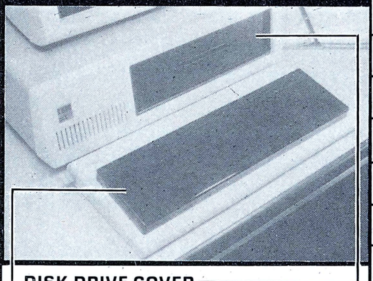

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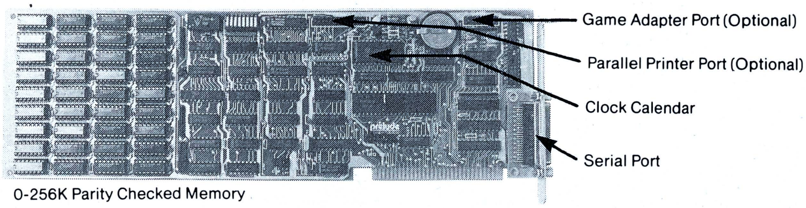
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Parallel Printer Port (Optional)
Clock Calendar
Serial Port

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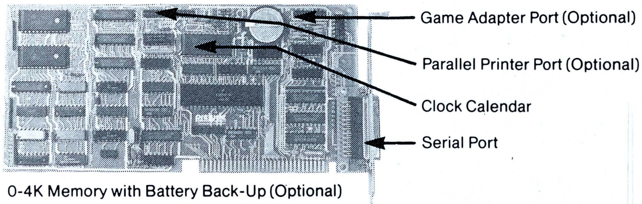
I/O Plus NV Memory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Parallel Printer Port (Optional)
Clock Calendar
Serial Port

0-4K Memory with Battery Back-Up (Optional)

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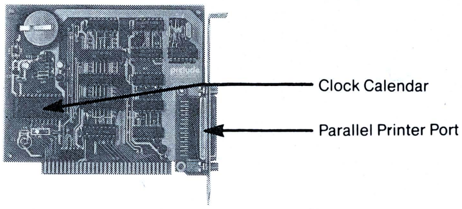
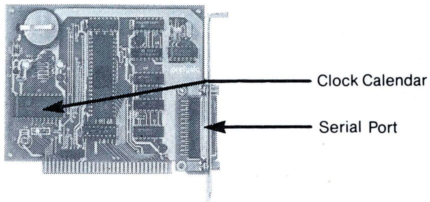


Clock Plus Serial Port



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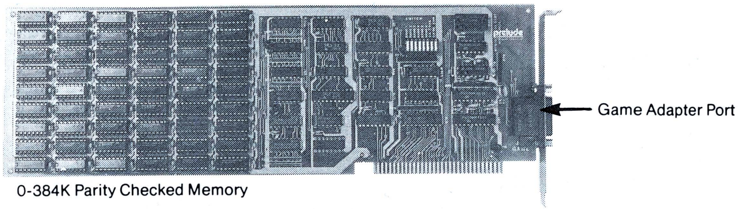

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Δ **Personal Bibliographic Software** (Box 4250, Ann Arbor, MI 48106; 313-996-1580) has announced the *Data Transfer System*, a program that allows the user to download records from on-line library catalogs such as OCLC and RLIN and automatically convert the records to correctly punctuated, formatted bibliographic citations in a personal database. The program works in tandem with the company's *Personal Bibliographic System*. $200.

Δ A "smart" mouse featuring a software driver that allows the device's control buttons to be used with existing application programs while simplifying application programming is available from **USI Computer Products** (71 Park Lane, Brisbane, CA 94005; 415-468-4900). The *OptoMouse* can be programmed using the driver to output any combination of ASCII codes. As a result, the mouse can control many programs by performing up to four commonly used functions at the touch of a button. $299.

Δ **PC Software Interest Group** (1556 Halford Avenue, Santa Clara, CA 95051; 408-247-6303) has announced the publication of a *Directory of Public Domain Software for the IBM Personal Computer.* Programs from computer clubs, bulletin boards, and individuals around the country are listed and cover a wide range, including financial and stock market analysis, word processing, communications, databases, Basic utilities, games using color graphics, Pascal and assembly language programs, graphics utilities, spreadsheet templates, RAM disks, and print spoolers. $2.95. Set of the ten most popular disks, $59. Complete set of seventy-five disks, $439.

Δ **Megahaus Corporation** (5703 Oberlin Drive, San Diego, CA 92121; 619-450-1230) has released a spelling checker to go with its *MegaWriter* word processor. *MegaSpeller* comes with a 40,000-word dictionary to which the user can add 10,000 words. $99.95.

Δ **BP Publications** (Box 617, Stiles Road, Southbury, CT 06488; 203-264-2143) has announced the publication of a bimonthly index to articles found in eleven magazines that cover the PC and its compatibles. *The IBM PC Index* covers *Byte, Creative Computing, Microcomputing, PC Magazine, PC Tech Journal, PC World, Personal Computer Age, Personal Computing, Popular Computing, Reference*, and, of course, *Softalk for the IBM PC.* Six issues, $28. Six issues and the annual cumulation, $34.

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Δ **Westford Systems** (69 Providence Road, Westford, MA 01886; 617-692-4381) has introduced a program that monitors PC usage within an organization. *Micro-Track* features a logon and logoff facility that records PC usage with little impact on users. In addition, a wide range of events, including software use, can be tracked. Information is stored at each PC as well as in a central database. $295.

Δ **Comshare** (3001 South State Street, Ann Arbor, MI 48106; 313-994-4800) has announced *Microseek*, a micro/mainframe communications software package that facilitates collecting corporate and public data for PC users. Additionally, information services managers can use the software to extend PC/mainframe linking to include error-free file transfers, "black box" PC/host applications, backup storage for PC files on the mainframe, and file transfers between remote PCs using the mainframe. $200. Five copies of program and mainframe file transfer program for error checking, $3,500, plus a $525 annual maintenance fee.

Δ A plastic reference card called *Micro Chart* is available from **Micro Logic Corporation** (Box 174, Hackensack, NJ; 201-342-6518). The chart covers conversion of instructions to and from hex. Instruction descriptions, cycle time, addressing modes, flag codes, register map, memory map, pinouts, ASCII, diagrams, cautionary notes, and more. $5.95.

Δ Churches can use the PC to extend their ministries with *Master Membership Profile* from **Membership Services** (Box 152130, Irving, TX 75015; 214-438-0581). The database management system can handle up to 2,000 records. Available output formats include mailing labels, selective listings, church directories, cards, offering envelopes, and pledge cards. $1,000.

Δ *DDPlus* from **The Alternate Key** (1400 Thatcher Road, Williamston, MI 48895; 517-655-3320) is a text formatter that allows users to regulate page margins, line spacing, headings, footings, file selection, and printer commands by using simple menu entries. The program microjustifies text on dot-matrix and letter-quality printers and produces true proportional text spacing on dot-matrix printers. It is compatible with *WordStar* and other word processors that use standard ASCII text files. $39.95.

Δ **Micro Planning Systems** (1499 Bayshore Highway, Burlingame, CA 94010; 415-692-0407) has introduced *The Professional Financial Planning System*, an integrated system for tax and financial advisers and individuals who manage their own financial affairs. The program calculates key federal and California state taxes for tax years beginning in 1983 and has a ten-year planning horizon. Requires 128K. $495.

Δ *OmniTerm 2*, an intelligent terminal communications package from **Lindbergh Systems** (49 Beechmont Street, Worcester, MA 01609), operates through a command-mode menu where all communications parameters are grouped in logical categories. $245.

Δ **CBS Software** (1 Fawcett Place, Greenwich, CT 06836; 203-622-2500) has introduced *Mystery Master: Murder by the Dozen*, a logic and deduction game playable by up to four would-be detectives. Players are challenged to investigate and unravel twelve cases of murder—all committed in the city of Micropolis. $34.95.

Δ *Draft-Aide*, a microcomputer-aided drafting and design system, is available from **United Networking Systems** (7007 Gulf Freeway, Houston, TX 77087; 713-644-2427). The system offers automatic dimensions, layering, grouping and degrouping, and lettering. It also has a symbol file that contains up to 500 active symbols that are created by the user and accessed by name. $595.

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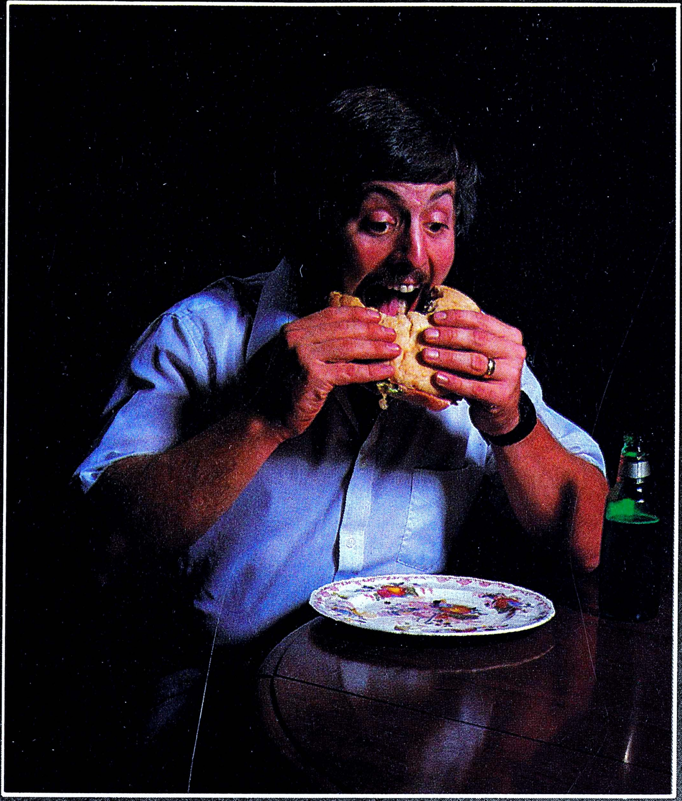

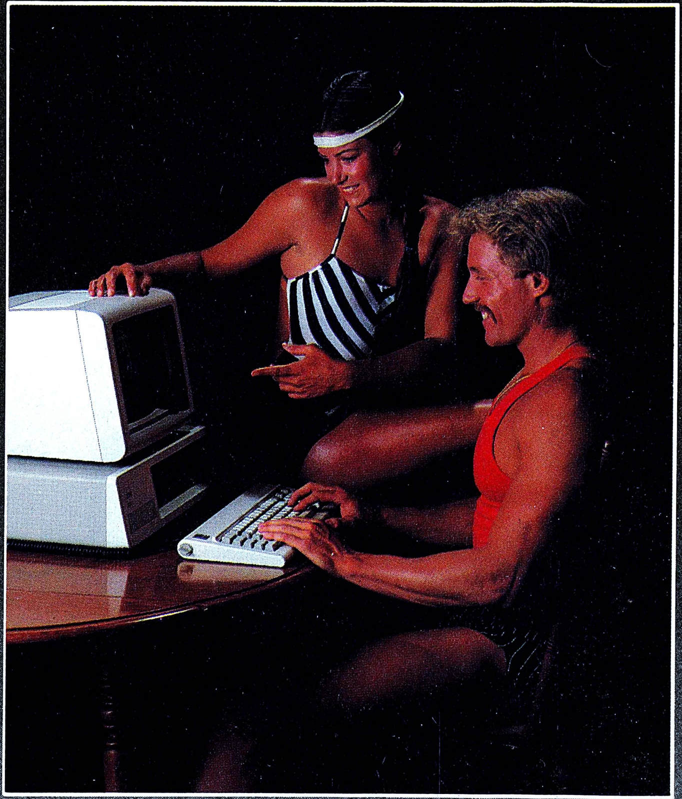

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Δ **Howard W. Sams & Co** (4300 West Sixty-Second Street, Indianapolis, IN 46268; 317-298-5400) offers *Computer Programs for Machine Design*, a collection of Basic programs to solve classic mechanical engineering problems involved in the design of machinery assemblies, subassemblies, and components. $21.95. Δ *Financial Planning Mind Tools for Lotus 1-2-3 and the IBM PC* is a collection of specialized overlays that perform eighteen kinds of financial calculations. $79.95.

Δ *MultiMate Jr. for the Peanut* is a version of *MultiMate* that has been adapted for use on the PC*jr* by **Softword Systems** (52 Oakland Avenue North, East Hartford, CT 06108; 203-522-2116). The program will look and act the same as *MultiMate* and work on a television screen or color monitor. Documents will be transferable between the two programs. $149.95.

Δ **Imagic** (981 University Avenue, Los Gatos, CA 95030; 408-399-2200) has introduced several games for the PC*jr*. In *Demon Attack*, hordes of winged demons attack a laser base. $39.95. Δ *Microsurgeon* places the player in the role of a microsurgeon maneuvering a tiny robot through a patient's blood stream, diagnosing and countering critical maladies in a race against time. $39.95. Δ *Football* features television camera perspective as players determine strategy and select and execute plays under real game conditions. $39.95. Δ *Baseball* features a realistic overhead view of the field when the ball is hit. Lifelike batters, pitchers, fielders, and lead runners are controlled by the players. $39.95.

Δ *QWERTYjr* is a version of the *QWERTY* word processor from **HFK Software** (Old Danbury Road, Danbury, NH 03230; 617-259-0059). The program is compatible with its PC cousin and uses standard ASCII files. The program was redesigned for the Junior's simplified keyboard. $99.

Δ Charles Goren, the man who "wrote the book" on contract bridge, has now developed the software for the PC. *Charles Goren: Learning Bridge Made Easy* is available from **CBS Software** (One Fawcett Place, Greenwich, CT 06836; 203-622-2500). The program teaches bidding and covers such topics as hand evaluation, opening bids, responses, and rebids. $79.95.

Δ A security package for hard-disk users is available from **Sophco** (1906 Thirteenth Street, Boulder, CO 80027; 303-444-1542). *Protec* has the ability to stop unauthorized boots from the A drive, segregate authorized users from one another, and encrypt sensitive files, directories, or floppies. $250.

Δ **Professional Software Technology** (Whistlestop Mall, Box 269, Rockport, MA 01966; 617-546-2073) has released two templates for *1-2-3*. *Personal Tax Planner* condenses *1-2-3* to seven single-letter commands. Numbers are entered only once, and linking carries the number to appropriate locations on supporting schedules and back to the 1040. $175. Δ *Time and Billing* uses simple associations for single-letter commands. Approximately twenty-five accounts, each with different billing rates, can be accommodated on each disk. A total of 10,000 cases or clients can be maintained, each with as many as 2,000 billing entries. $175.

Δ **Microbase Software Incorporated** (Box 34163, Indianapolis, IN 46234; 317-291-0880) has released *The Adman System*, a multimodule package of business software for the XT, designed for the small to medium-sized advertising agency. Five integrated modules perform a variety of accounting, billing, and reporting functions. $3,295.

Δ **Ven-Tel** (2342 Walsh Avenue, Santa Clara, CA 95051; 408-727-5721) has introduced two modems. The *PC Modem Half Card* is a full-featured 1200/300-baud, autoanswer, autodial modem for the XT that fits in the small expansion slot. $549. Δ *The PC Modem 1200* is an internal 1200/300-baud modem that fits in one slot of the PC, XT, or Compaq. It includes autodial, autoanswer, tone or rotary dialing, and full- or half-duplex. $499.

Δ **Continental Software** (11223 South Hindry Avenue, Los Angeles, CA 90045; 213-410-9466) has introduced *F.A.S.T.*, a series of templates that convert *VisiCalc* data into comparisons and reports for analyzing

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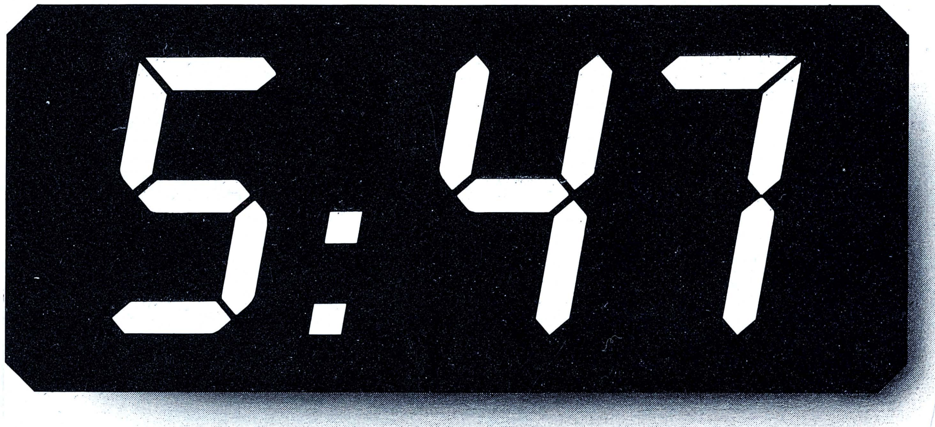

(time to sort 1,000 records)

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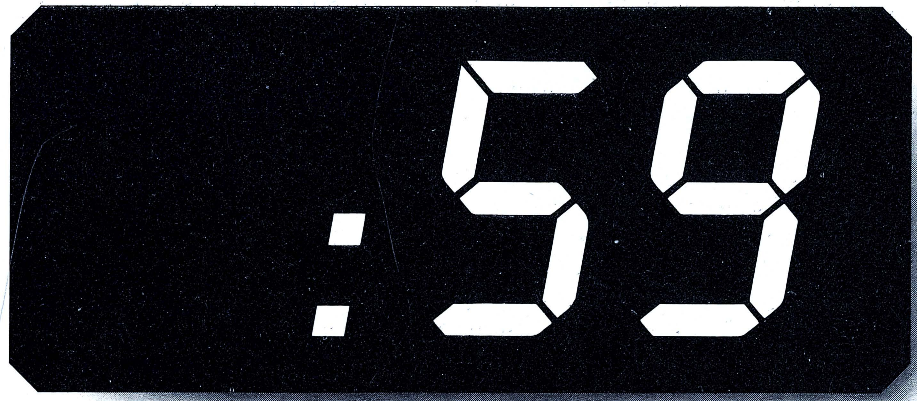

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a variety of financial statements. Twelve separate worksheets and programs are included in the series. $99.95. Δ *Ultrafile* is an integrated file manager that accommodates databases of up to 32,000 records, 1,000 characters per record, fifty data items per record, and 100 characters per data item. The program is menu-driven and can interface with popular spreadsheet and word processing programs. Requires 128K, two double-sided drives or a hard disk. $195.

Δ Version 3.0 of *ProKey* has been released by **RoseSoft** (4710 University Way N.E., Seattle, WA 98105; 206-524-2350). The program can be used to customize and enhance any software program by assigning new definitions to keys selected by the user. The new definitions can contain anything from a single character to more than twelve thousand characters of text or commands. $129.95.

Δ *Screen Saver+* is a collection of preventive maintenance programs from **Logical Systems Corporation** (Route 1, Box 253, Saint Michael, MN 55376; 612-497-3861). The program protects against phosphor burnout by blanking the screen after a user-programmable period of keyboard inactivity. A disk-timing utility keeps track of and reports the accumulated time a disk has been used. Also included are a memory test, a disk drive and disk test, and a disk drive cleaning utility. $19.95.

Δ *Cadplan* is an easy-to-use package that turns the PC into a computer-aided design workstation. Available from **Personal CAD Systems** (15425 Los Gatos Boulevard, Los Gatos, CA 95053; 408-356-3183), the program is suited for two-dimensional design applications, such as floor-plan layouts, placement of furniture or equipment in industrial buildings, and designing mechanical systems. $1,200.

Δ **Connecticut Software** (30 Wilson Avenue, Rowayton, CT 06853; 203-838-1844) has introduced *Printer Basher,* a utility program that provides full menu-based operation of all control functions and print modes of all Epson printers. With the aid of a menu and a few keystrokes the user can send all control codes necessary to set up the printer in seconds. It also enables the three IBM character sets that are "missing" from the Epson printers to be downloaded to the FX series. $29.95.

Δ **North America MICA** (11772 Sorrento Valley Road, San Diego, CA 92121; 619-481-6998) has announced *BMP,* a complete bill-of-materials processor and engineering, documentation, and control system that provides control over product development, prototyping, costing, and production. The system can hold up to 32,000 master records plus 32,000 product structure records per password-protected database. Requires CP/M-86 and CBasic-86. $995.

Δ **Telescan** (1400 Post Oak Boulevard, Houston, TX 77056; 713-877-1206) is offering a color graphics investment analysis program and on-line database providing customized individual stock graphs for from one month to ten years with various types of analysis. *Telescan* features technical analysis that includes moving averages, cycles, momentum, trendline, on-balance volume, cash flow and capital spending, inflation adjustment, and proprietary indicators. Requires 128K, color/graphics adapter, and Hayes Smartmodem. Program and one-year subscription to database, $300.

Δ **Beck Manufacturing** (Box 111, Main Street, West Peterborough, NH 03468; 603-924-3821) has introduced a new 5 1/4-inch floppy disk, which it will market only in the *Beck 25 Pack*. Single-sided, double-density, $54.75. Double-sided, double-density, $69.75.

Δ *The Bookkeeper,* a computer-aided bookkeeping system, is available from **Privet** (Box 81, Middleton, WI 53562; 608-833-1134). The package is designed to adapt to the individual bookkeeping needs of small-to-medium businesses. It features an integrated accounts payable and general ledger packaged into a single module. Requires 128K and two disk drives. $495.

Δ **New Era Technologies** (2025 Eye Street N.W., Washington, DC 20006; 202-887-5440) announces *MIST+*, the PC version of its integrated communications package. The software can be used to access popular on-line services. $295.

Δ *Perfect Link,* a telecommunications program from **Perfect Software** (702 Harrison Street, Berkeley, CA 94710; 415-527-2626), uses an automatic installation system to work with eight information and communications services, including MCI Mail, Western Union Easy Link, Dow Jones Knowledge Index, and The Source. An automatic dialing and log-on capability allows users to define all relevant parameters and permits one-button access to each service. $149.

Δ **CACI** (1815 North Fort Myer Drive, Arlington, VA 22209; 703-841-7800) introduces *RL-1,* a relational database management system that gives easy access for the user or user programs to several tables at once in a fully integrated data environment. $495.

Δ *ASAP Five,* a database management system that is designed to allow users to produce reports within fifteen minutes, is available from **ASAP Systems** (2425 Porter Street, Soquel, CA 95073; 408-476-3935). $575.

Δ **Eagle Computer** (983 University Avenue, Los Gatos, CA 95030; 408-395-5005) has announced three IBM-compatible computers. *Eagle PC Plus XL* is a desktop model with a 10M hard disk. $4,295. Δ The *Eagle Spirit* is a portable with two floppy-disk drives, built-in graphics, and a nine-inch screen. $3,295. Δ The *Eagle PC Plus* is a desktop with one or two floppy-disk drives. $2,395 and $2,795, respectively.

Δ *Hypergraphics* is a complex color graphics package written in assembly language and Basic using encoded graphics. It can store up to 1,000 color graphic screens on a 320K disk. Available from **Hypergraphics Corporation** (First City Bank Center, 100 North Central Expressway, Richardson, TX 75080; 214-690-3000). $395.

Δ **Computer Graphics Group** (568 Fourteenth Street N.W., Atlanta, GA 30318; 404-876-9469) has announced *PC Illustrator,* a general-purpose graphics picture generation, editing, and presentation package. The program uses icons to simplify locating and selecting commands. Requires 128K and color/graphics adapter. $119.95. ▲

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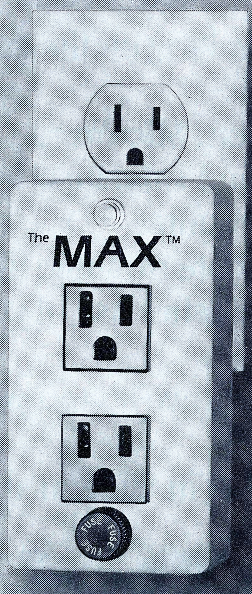

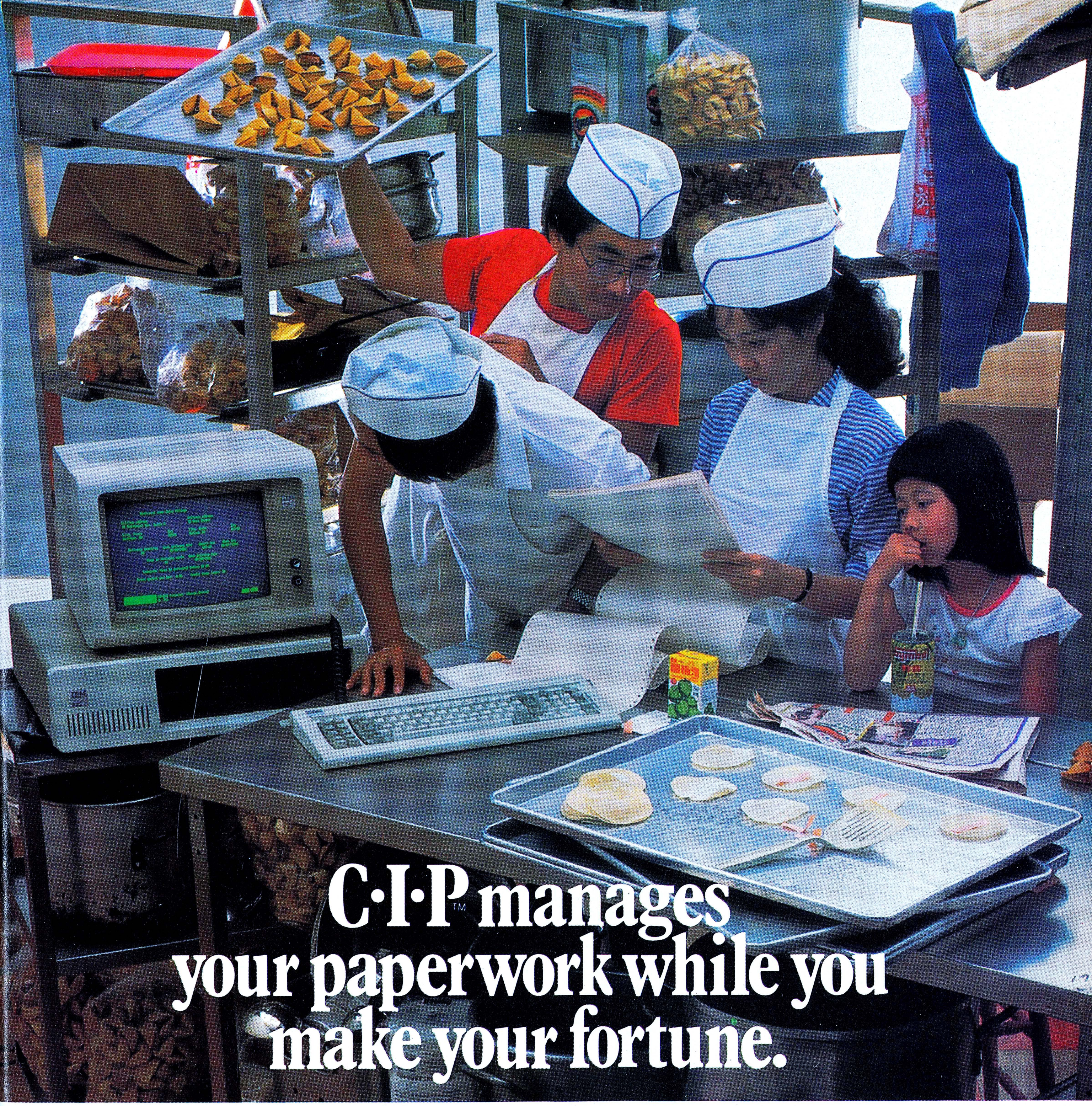

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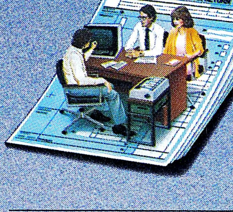

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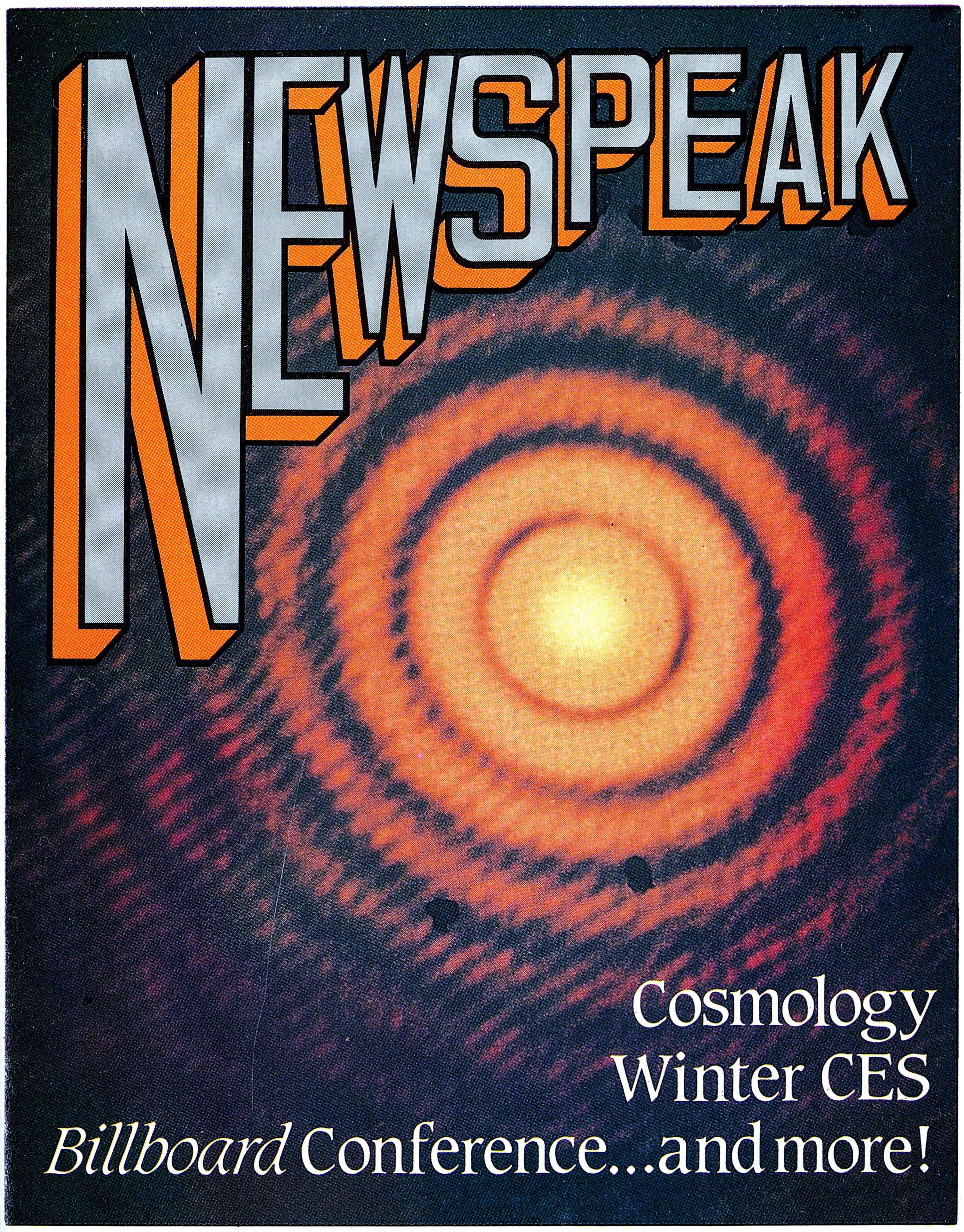

No, it's not the Big Bang. The picture above is the diffraction pattern of a helium-neon laser. Photomacrography by John Carnevale, courtesy of AT&T Technologies.

SCIENTISTS PONDER BIG BANG WITH COMPUTER SIMULATIONS

Most physicists agree that modern cosmology—the study of the origin, evolution, and structure of the universe—was born in 1965, when Bell Laboratory scientists Arno Penzias and Robert Wilson accidentally discovered cosmic static. This feeble wash of microwaves is generally considered to be a signal dating back to the universe's beginning. Since their remarkable discovery, which won the two scientists a Nobel Prize, the standard explanation for the origin of the universe has been the "big bang" theory, according to which the physical universe expanded—and is expanding still—from an unimaginably hot and dense point as the result of a gigantic explosion some fifteen to twenty billion years ago.

In the 1920s, Einstein applied his general theory of relativity to cosmology. Instead of finding a static universe, as he expected, Einstein found that the universe must be either expanding or contracting; a static universe could not be stable. A few years later, American astronomer Edwin Hubble demonstrated that the universe was indeed expanding—that the galaxies were all rushing away from

GOTO page 176, column 2

AUTHORS STRIVE TO PERFECT A STANDARD BASIC

It's been twenty years since Dr. Thomas Kurtz and Dr. John G. Kemeny introduced Beginners' All-Purpose Symbolic Instruction Code, or BASIC, to the world of computing. What began as a small project at Dartmouth College in New Hampshire ended up bringing the power of computing to millions.

Kemeny and Kurtz's BASIC was easy to use. It was so easy that it's still the most popular programming language. The original edition of BASIC, although copyrighted, was distributed freely to anyone who wanted to use it. But as the number of computer models increased during the intervening years, a like number of versions of BASIC arose with them. It seemed that each new computer required, for one reason or another, a different version of the language. Through the years, some pretty bad implementations of "old" BASIC gave the language a bad name in some computing circles.

Reacting to the Babel-like confusion and the possibility of someone rushing out with a less-than-wonderful structured version of BASIC, Kemeny and Kurtz have joined forces once again to write the definitive version of BASIC, called True BASIC.

"It was due to the confusion between BASICs that we decided to start this effort," says Kemeny, who is still at Dartmouth. "No two BASICs on personal computers are compatible. And all the current versions are quite out of date from the perspective of those of us who have been involved in language development for a long time."

In 1974 the National Standards Committee of the American National Standards Institute (ANSI) began the slow process of developing a voluntary standard for BASIC. A "minimal" BASIC standard appeared in 1978. Now, Kemeny—who chairs the ANSI subcommittee—sees a way to perfect the language and to introduce a structured version that meets the specifications of the new "full" standard.

According to ANSI officials, anyone is free to develop a version of BASIC that meets the standard. It is rumored that several large companies are working on their own implementations. So Kemeny and Kurtz are in a race to get True BASIC finished and on the market. This time it won't be available for the asking.

Kemeny and Kurtz formed a small private company named True BASIC in August 1983.

GOTO page 179, column 1

HEROISM IN THE MODERN AGE

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Winter CES Invades Las Vegas and The Gambling Pays Off for Most

It was business as usual at the 1984 International Winter Consumer Electronics Show, held January 7—10 in Las Vegas, and most participants breathed sighs of relief. Beyond the flood of gewgaws and the gigabits of misleading information, there was actually some worthwhile business transacted during the show.

The exhibitors came from all over the world and unveiled a wide range of merchandise, all loosely related by the term "electronics." Reacting to the breakup of AT&T, dozens of firms offered phone equipment—everything from Specialty Phone's Phonafootball ("America's favorite sport is now America's favorite telephone") and Phonaduck to AT&T's System 1000 cellular telephone. Quite a bit of acreage was devoted to telephones, watches, clocks, and other high-tech household items, such as Technasonic's Pest Raider.

Most of the major video and audio firms, and plenty of the minor ones, were present. Videodiscs, compact digital discs, and newly released movies on videocassette were the marketing thrust of these companies. More than one exhibitor in the consumer video industry found an excuse to hook up a VCR and a monitor and show *Making Michael Jackson's "Thriller"* on a continuous loop.

Personal computers and video games held their own amidst the near-hysterical high-tech wash. There were plenty of new computers and some new software products. Apple, of course, chose not to announce or display Macintosh. Instead, the company took a small booth off to the side and courted the education market. IBM chose to skip the scene altogether, although the PC*jr* was in evidence at various booths.

Microsoft's MSX standard (see "Newspeak," August 1983) continued to fail to cause excitement. SpectraVideo was the only American company at the show with an MSX computer, and they had to obtain demonstration cartridges from a company in Hong Kong (which had, in turn, imported them from Japan). The three U.S. companies that had previously announced support of MSX—Spinnaker, Sirius, and Sierra On-Line—modified their positions somewhat, saying in effect that they'd support MSX if it ever became popular.

Commodore showed the software-bundled 264 (to be officially introduced this April Fool's Day) and held its twenty-fifth anniversary/we-made-a-billion-dollars-this-year party at the MGM Grand. The company's top brass addressed the assemblage and kidded around about Commodore's high employee turnover rate. Chairman Jack Tramiel spoke in glowing terms about the performance of his company and its commitment to the future (he resigned five days after the show).

Coleco was up to its old piggyback tricks, announcing another "plug-in module," this one making the company's Adam computer compatible with the PC. The company will also bring out a videodisc player for the Adam.

Leonard Nimoy stood quietly at the HESware booth, busily signing autographs for his new role as corporate spokesvulcan for the Commodore software house. In an unrelated development, Sega drew crowds across the way with more personal computer versions of *Star Trek: The Search for Spock* than you could shake an EPROM at.

After four days of dealing, demonstrating, gambling, and partying, the 1984 Winter CES came to a close. The Summer CES will be held in Chicago June 3—6. AC, DH

Billboard's Video And Software Show Slated for March

Billboard, a leading music industry weekly, is sponsoring a three-day conference on computer software and video games at the Westin Saint Francis Hotel in San Francisco March 7. Attendees should have serious avocational, if not vocational, interest in the subject, as registration is $350.

The conference includes ten lectures, an awards banquet, an experts' panel luncheon, and numerous demonstrations of new entertainment, educational, and home management software designed for Apple, IBM, Atari, and Commodore microcomputers.

The registration deadline is March 5. For more information, call or write *Billboard*'s Beverly Hills, California, office.

Last spring's *Billboard* conference, the first of its kind sponsored by the magazine, drew about one hundred fifty manufacturers, programmers, retailers, and distributors, and focused on video games. This conference, which will focus primarily on microcomputer ware, is an extension of the magazine's expanding coverage of the software industry—a progression that has gone from music to music videos to video games to home computer software, particularly entertainment software.

Billboard began editorial coverage of the software industry about a year ago, with reports on new products and the retail end of the business. The publication began the charting of bestselling software about six months ago. It charts the top twenty entertainment titles, as well as the top ten education and home management programs. The weekly survey covers overall sales for all the most popular brands of personal microcomputers. JP

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Assembly Lines: The Book
By Roger Wagner
An introduction to 6502 assembly language programming for the novice.
272 pages ISBN 0-88701-000-8
$19.95

Graphically Speaking: Portrait of the Artist as a Young Apple
By Mark Pelczarski
An in-depth tutorial on creating hi-res graphics and animation on the Apple computer.
184 pages ISBN 0-88701-007-5
$19.95 book/$9.95 disk/$27.95 book and disk

The Inevitable Beginner's Manual: Getting to Know Your PC
By Craig Stinson
An introductory guide to the IBM Personal Computer.
128 pages ISBN 0-88701-004-0
$9.95

Macintosh! Complete
By Doug Clapp
The unique and definitive book on the Apple Macintosh computer.
344 pages ISBN 0-88701-009-1
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Cosmology

continued from page 173

us (and each other) at a speed proportional to their distance. This discovery was taken to be the confirmation of the big bang theory.

The task of modern cosmologists, using recent developments in particle physics coupled with relativity theory, has been to run the universe back mathematically—to reverse the cosmic film of time and space, so to speak. The tools used to create these universal biographies are large computers.

By feeding computers huge batches of data based on particle physics, scientists hope to simulate the evolution of several possible universes. In response to this data, the computers provide graphic snapshots of these various models at different stages of development.

The reason for all this effort is obvious. There are too many unanswered questions about the universe; answers could be relevant to our present existence. Why is the matter in the universe distributed in the manner in which we find it? Is the universe composed of primarily luminous matter, or some dark cosmic constituents eluding our vision? The laws of physics dictate that if there's too much matter in the cosmos, eventually the universe will fall back on itself. Could it be that we are in an expansion phase of a perpetually oscillating system?

Reconstructing the history of the entire universe is no simple task, and even the largest computers help cosmologists glimpse only part of the picture. The best methods, for the moment, involve simplifying the model in question until it's stripped of all but the most pertinent characteristics.

Nearly all simulations done to date have illuminated the cosmic history of only one kind of particle at a time. In the early 1970s, simulation studies were focused on hydrogen, the most abundant element in the known universe. Cosmologists first looked to see whether hydrogen was randomly distributed at the birth of the universe (the hydrogen we know of today is certainly not randomly distributed; it's clumped into galaxies, oceans, and living beings).

Results of those initial studies suggested that hydrogen was not randomly distributed at the beginning. But the studies could not account for such nonrandom current phenomena as superclusters—enormous spaghetti-like strings of clusters of galaxies. Essentially, the present universe consists of these superclusters, separated by vast wastelands nearly devoid of matter.

In attempts to verify a random distribution of matter, astrophysicists in the 1970s used the "auto-correlation" function. Starting with any particular galaxy, the auto-correlation function measures the odds of finding another galaxy at any given distance. Generally, this probability varies as the distance changes.

But when the computers' predictions were compared with real astronomical observations, they did not match. Cosmologists went back to their proverbial drawing boards and tried to posit an initial condition that would produce a universe made up of superclusters and voids. They're trying still. Some interesting scenarios are emerging as a result of this work.

Current cosmological theories postulate that, as positively charged protons began to latch onto negatively charged electrons to form hydrogen in the cooling half-million-year-old universe, photons (elementary particles of light) were freed from their bondage to this matter. Such "decoupled" light then traveled, more or less unopposed, throughout the cosmos. These photons are relics of the big bang and offer a glimpse of what the universe once was like.

Ancient photons, their energy diminished to the level of microwave radiation, were the annoying static that Penzias and Wilson discovered in 1965. Further measurements have shown that the earth receives the same amount of this electromagnetic background noise, at the same energy levels, from all directions in space. This uniformity indicates that the photons were evenly distributed at the time of their decoupling—implying that protons and electrons were evenly distributed as well.

However, computer simulations have shown that the supposed smooth initial distribution of light and hydrogen cannot account for the observed clumping of matter in the present universe. In the late 1970s, researchers realized they had probably oversimplified their computer models. So, in recent years, such notions as "inflation"—first proposed by MIT's Alan Guth—have become popular theories for explaining what happened during and right after the bang.

The possibility that there's some kind of matter in the universe that has so far eluded our observation is also a big topic among cosmologists. Clustered galaxies clocked at high speeds have been puzzling astrophysicists for years. The mass of these clusters appears to be insufficient to hold them together by gravity alone; but the estimations of their mass have been based on the amount of luminous matter they contain. Perhaps there's some electromagnetically "dark" matter providing additional gravitation.

GOTO page 179, column 2

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Basic

continued from page 173

The pair felt the need to do their work away from the academic environment. With three systems programmers currently in their employ, the pair plans to aim the product at the educational market.

"We hope that True Basic will make it vastly easier for people to write and understand the language. We're promising interested parties that within two years they can have True Basic running on all of the leading personal computers."

Publishing houses—which currently are in the uncomfortable position of having to bring out numerous versions of any book that contains Basic programs—have expressed interest in True Basic.

"We hope that in the future these companies can publish just one book written in True Basic," says Kemeny. "Oh, they'll have to have different disks for the varying systems, but the authors will only have to write the code once. Several publishers are very excited, and we're very close to signing a major contract."

Not everyone, though, is enthusiastic about a standard Basic. Many companies have invested enormous amounts of money in old versions, and they will look long and hard at anything new before dumping what they've supported up to now. If the language becomes popular, however, the wait-and-look attitude may change.

What differences are there between the old Basics and True Basic?

"The most important feature is that True Basic is a fully structured language," Kemeny explains. "If one had to compare it to another language, Pascal would be a good example. True Basic has room for external procedures, and the programs are very easy to read.

"True Basic is also compiled," Kemeny adds. "This compiling pass is really crucial. A compiler will find all of a program's syntactic errors very quickly. These are the most common errors. The program will not run until it is free of these syntactical problems. Now, if the errors happen to be located way down in the program code, an interpreted Basic will grind away until it gets to that particular line where the error is located. After wasting ten minutes, you're informed of the error."

Kemeny indicates that he and Kurtz are trying for a happy medium. They have spent a great deal of time on the design of the language. A full compiler is usually too large to operate within the confines of a small computer. Consequently, True Basic will offer half-compiled and half-interpretive operations.

"When we first wrote Basic, it was very simple," Kemeny says. "Over the years, advanced features were added. My design criteria was that no advanced feature could be added to Basic if it made life harder for the beginning student."

Field-testing of True Basic will take place this summer, with a version available for the IBM PC by September of this year. Why was the PC picked as the initial vehicle for True Basic?

"At the time our company was formed last year, Macintosh and the PC*jr* hadn't been announced," Kemeny explains. "We picked a popular computer with the necessary amount of memory." Because of the compiler, it takes a 128K machine to run True Basic. "There will be a Macintosh version in the not-too-distant future. There won't be a version for eight-bit computers because of memory constraints."

Kemeny is enthusiastic about the future of True Basic. "This is an extremely high-quality language with a wonderful user interface," he states. "True Basic is much larger and far more powerful than current Basics."

HL

Cosmology

continued from page 176

Cosmic dust, cold planet-sized rocks, black holes, and a variety of subatomic particles have been nominated for the dark-matter role. These candidates, however, were eliminated by cosmologist Adrian Melott, whose computer simulations showed that for the matter to be baryonic (to consist of protons and neutrons clustered in atomic nuclei) there would have to be far more helium and deuterium in the universe.

Another candidate for the dark mass was the elusive neutrino—an elementary particle decoupled from the rest of cosmic matter early in the life of the universe. Neutrinos may have had lumpier distributions than hydrogen at the photo-decoupling epoch (the usual starting point for computer simulations). The evidence was encouraging, but there was one problem: neutrinos are allegedly massless. In 1980, however, a controversial Soviet experiment claimed to show that neutrinos do have a minuscule, but definitely nonzero, rest mass.

The neutrino would provide about the right amount of missing mass to explain the cohesiveness of galactic clusters, and initial computer simulations along these lines—tracking only neutrinos—resulted in collections of matter much like those we observe today. Some researchers believed that ordinary "hydrodynamic" baryonic matter (found in stars and human beings) would probably tag along with the neutrinos.

But when the auto-correlation function (the observed probable distance between galaxies) was applied to these models, the computer snapshot showed a universe too young to correspond to the one we know and love. In it, matter would be just starting to clump—indicating that the galaxies were formed just the other day, cosmically speaking; and this is not consistent with observation. Researchers now realize that for the simulations to be accurate, baryonic matter (not just neutrinos) must be included as well. And they are proceeding with simulations along these lines.

Other researchers are considering still more controversial particles as the dark matter. The latest models rely not on known particles but on theoretical massive particles that may or may not exist—such as axions, gravitinos, and photinos.

GOTO page 180, column 2

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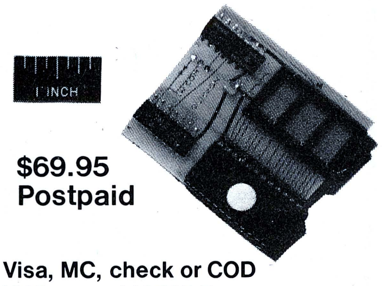

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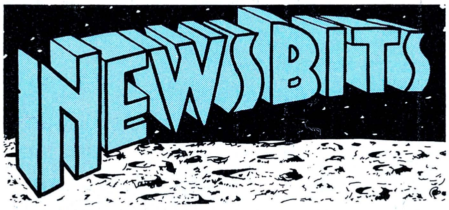
Cosmology

continued from page 179

Cosmologists are a long way from solving all the mysteries of the universe. The speed and storage capabilities of present-day computers have been strained to the limit. So cosmologists now await the advent of bigger, better, and faster computers—the much-anticipated Fifth Generation. It is perhaps presumptuous to think that better machines will help us understand totally an event that occurred twenty billion years ago, but they certainly offer us a better chance of understanding our past, our present, and (possibly) our future. DH



Δ **Collector's Item.** Buyers of Pryority Software's new adventure, *Forbidden Quest,* may be getting more than they expected from the art prints included with the game. The prints, by comics artists Frank Cirocco and the late great Wally Wood, are provided as a bonus and as a source of clues to the adventure. That, of course, is a fair incentive for adventurers who appreciate artwork, especially since Wally Wood is known as one of the "Golden Age" artists in the comics field; his work for EC Comics in the 1950s is now legendary. Wood died suddenly late in 1983, and this could further increase the value of his single-color print included with Pryority's game.

Δ **"You Toucha My Micro, I Laugha in Your Face."** A new product with the potential to reduce the theft of car radios, TV sets, telephones, and other microprocessor-controlled products was recently introduced by International Electronic Technology Corporation of Far Rockaway, New York. The company has developed what it calls the Kaish Circuit Lockout System, an electronic coding program that can be applied to microprocessor chips. The system makes use of three different digital codes. Two are applied at the factory; the third is a personal code of the owner's choosing. Once a unit is fully programmed, disconnecting it from the power source or tampering with it in any way will render it inoperable unless the proper owner-specified code is entered. The idea is to deter the theft of many common electronics products by making them unsalable. The company estimates that adding the Kaish Circuit Lockout System to a product will add less than five dollars to the item's manufacturing cost. International Electronic Technology has applied for a patent on its system and plans to license it to manufacturers.

Δ **No Burning Notebooks When School's Out.** A study conducted by International Resource Development (Norwalk, CT), a technology-oriented market research firm, predicts that by 1988 an increasing number of students will use portable notebook-sized computers for doing homework, taking notes, and grading their teachers. Students' computers will be interrogated by the Board of Education computer; thus, the board will be able confidentially to track students' progress as well as their teachers' effectiveness. At year's end, the teachers' "grades" would be used as the basis for determining merit pay, says Jan Ancker of the IRD research staff. Through the years, the computer would retain in memory the speed at which a child learned each subject, as well as pertinent facts about the child's educational history and achievements. "As the child approaches eighteen, the Scholastic Aptitude Tests will be rendered unnecessary for admission to colleges," Ancker predicts. A student's degree of knowledge and rate of mental development will be available to the college of his choice straight from the sealed memory chip in his notebook computer.

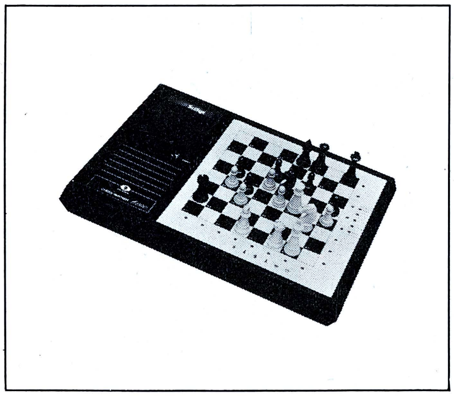
Δ **Dishing Out Satellite Info.** The Book Publishing Company (Summertown, TN) has released *The World of Satellite Television*. The book's authors, Mark Long and Jeffrey Keating, have compiled a reference guide for the accomplished home video enthusiast as well as an easy introduction to satellite technology for the newcomer. The 224-page volume covers receiving dishes, feedhorns, low-noise amplifiers, polarizers, and other accessories, as well as providing information on troubleshooting, legal concerns, and methods of installing your own system. *The World of Satellite Television* also includes useful facts about existing satellite channels in different parts of the world.

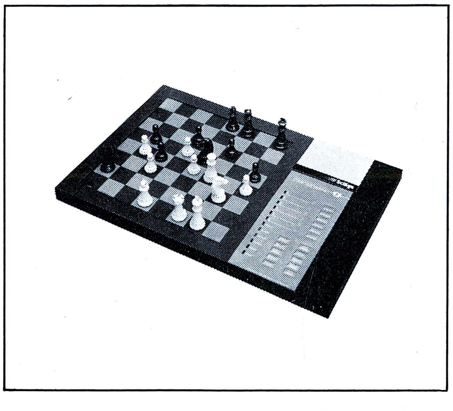
Δ **Hotel Modem.** Some hotels provide computers for their guests, and some make it easier for guests to use their own machines. Soon, people who stay at the Stanford Park Hotel in Menlo Park, California, will be able to use their personal computers with a minimum of hassle. The 165-room hotel, scheduled to open in May, will feature an extra telephone line in every room so that guests can communicate with the outside world by modem. In keeping with this high-tech approach, the hotel rooms don't have conventional keys. Instead, each guest will be assigned an electronic card programmed with a combination. When a guest checks out, the combination will be changed; thus, the Stanford Park will be providing one of the most advanced security systems available.

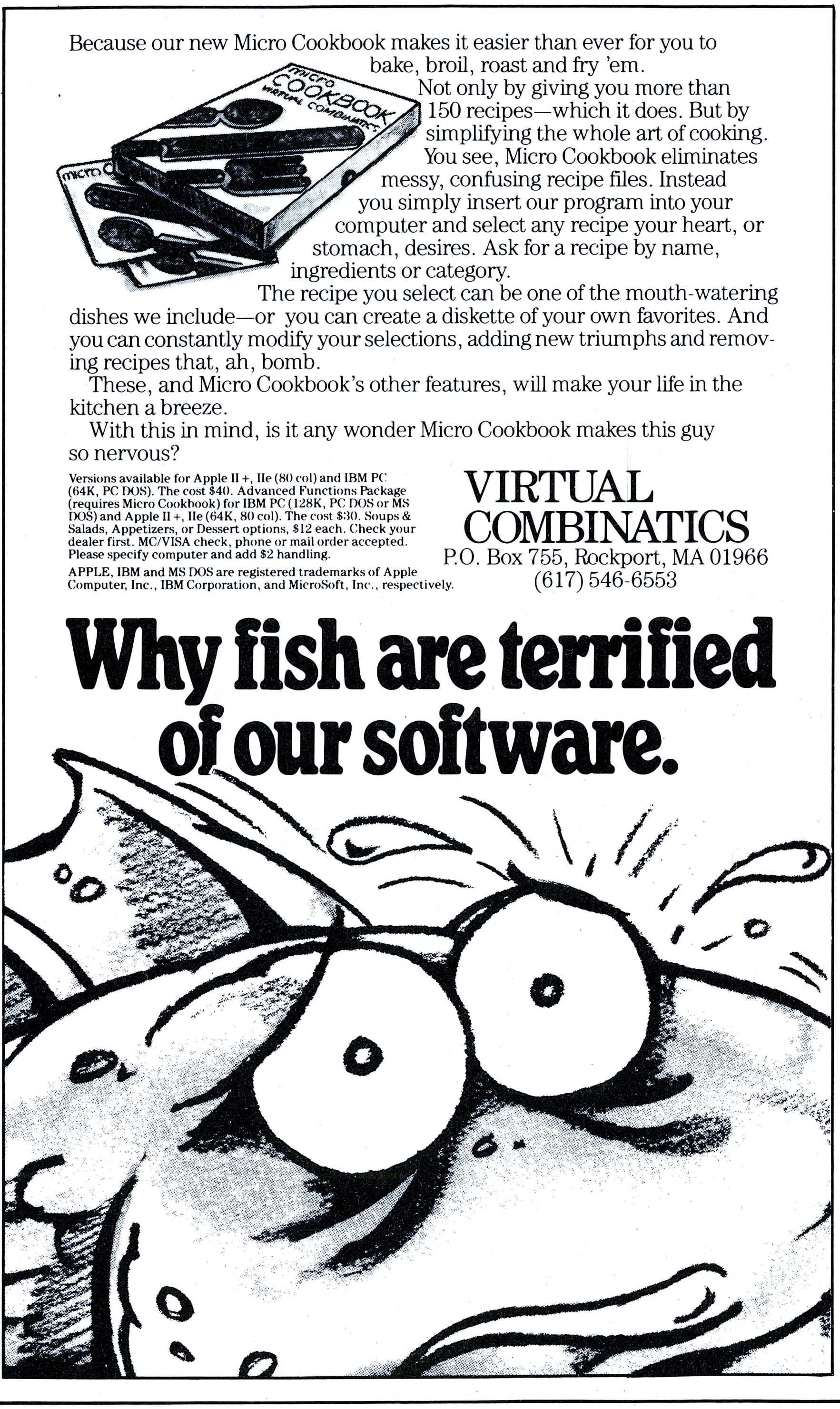
Δ **Tackling the Two Thousand.** Future Computing (Richardson, TX), an information services firm specializing in the personal computer industry, has released The Fortune 1000 Personal Computer Market Report. The report indicates that in 1985 alone, companies in the Fortune 1000 will buy more personal computers than were sold to all major United States corporations before 1984. According to the report, the 2,000 largest firms accounted for 24 percent of the $6-billion office personal computer hardware market in 1983. By 1985, office personal computer hardware will reach sales of $12.1 billion, with the share sold to the 2,000 largest firms reaching 31 percent. The report also predicts that direct sales will be an increasingly important distribution channel for hardware manufacturers and software publishers. According to Future Computing senior consultant Michael Stone, "Large corporations prefer to deal directly with their suppliers. They'll buy personal computers and software from the relatively small number of vendors who can develop direct sales and support teams."

Δ **"Your Move, Bit Brain."** SciSys Computer (New York, NY) recently released half a dozen new computer chess games—ranging in price from $29.95 to $179. *Superstar* is a 28K—expandable to 36K—system that boasts twenty-four levels of play, tailored to meet all aspects of the game for players of all ratings. *Companion II* is a table-top, battery-powered model featuring nine adjustable levels of play, from beginner to more advanced. The *Concord* is a high-speed, table-top unit with nine adjustable levels of play. *Explorer* is a portable, battery-powered, nine-level chess computer. A built-in memory mode enables the unit to remember the last position of a game in progress for up to one year—even if the computer is repeatedly turned on and off. *Travel Mate* features four levels of play and is perhaps the smallest portable chess computer on today's market. *Chess Partner 6000* is a table-top unit that features eight adjustable levels of play. SciSys Computer manufactures the only chess computers endorsed by FIDE, the World Chess Federation.

Δ **Gap Gathering.** A national conference, "Computer Technology for the Handicapped," will be held in Minneapolis, Minnesota, September 13—16, 1984. Sponsored by *Closing the Gap* (an international newspaper covering microcomputer applications for the handicapped) and TAM (the Technology and Media division of the Council for Exceptional Children), the conference is designed







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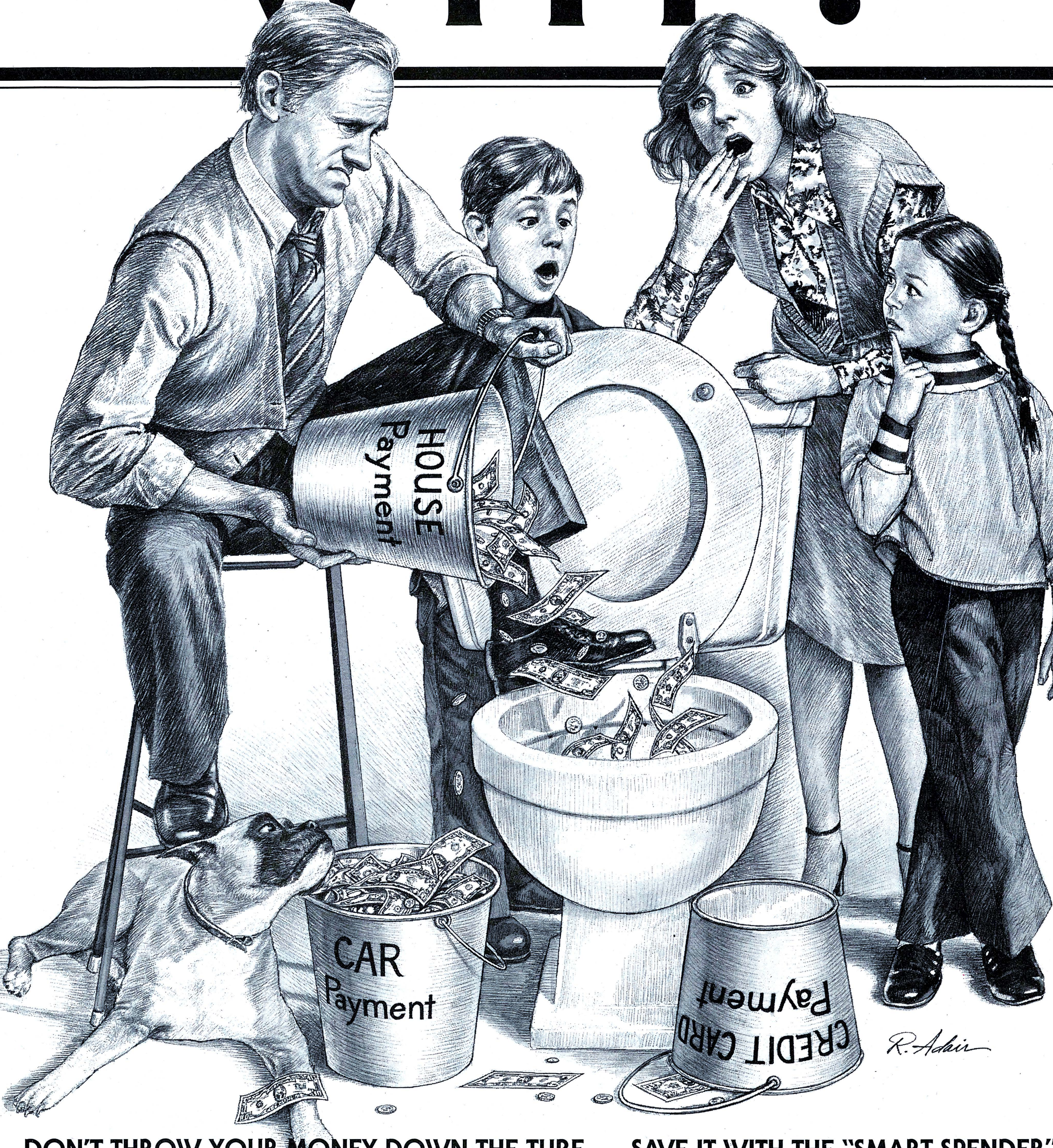

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to provide information to parents of handicapped children and to disabled individuals themselves. There will be more than eighty presentations and three, three-hour workshops, as well as an exhibit floor. For information on fees and registration, contact Closing the Gap in Henderson, Minnesota.

∆ **Opting for Optics.** Technology Opportunity Conference (San Francisco, CA) is holding a meeting called Optical Storage of Documents and Images March 13—15 at the Biltmore Hotel in Los Angeles. Read-write and read-only storage of analog and digital information—including office documents, engineering drawings, and parts catalogs—will be covered and demonstrated. For further information, contact Technology Opportunity Conference in San Francisco.

∆ **Southern Style CAD.** The 1984 Computer Aided Engineering and Manufacturing Seminars and Exhibition will take place May 7—11 at North Carolina State University in Raleigh, North Carolina. For more info, contact the NCSU division of continuing education in Raleigh.

∆ **Tubular Computers and Roboobs.** Computers and fanciful robots are popular items these days in Hollywood. NBC's *Knight Rider* features a computerized car named KITT, with a voice that sounds like HAL in *2001: A Space Odyssey.* ABC's midseason entry *Automan* focuses on a translucent crime fighter, a computer game figure brought to life by a young cop—Pac-Man wearing a white hat. The neon Automan has a holographic sidekick named Cursor. NBC's midseason newcomer *Riptide* features a faintly reptilian-looking Roboz the robot. And a computer is a regular on NBC's *Silver Spoons*; the main character uses it to predict the outcome of football games and to gain access to databases. Both ABC's *Blue Thunder* and CBS's *Airwolf* feature high-tech, computerized helicopters. Later this year, ABC will air a two-hour TV movie/series pilot called *Midas Valley*—a Silicon Valley saga by Ann Bickett.

∆**Bank of Americomputer.** Taking a big leap into the uncertain waters of electronic banking, Bank of America announced two months ago that it will allow customers with home computers to pay bills and use other banking services by hooking into the bank's computer system. The San Francisco-based bank said the service is being offered immediately to customers with checking accounts at its 540 branches in northern California. Plans call for the system to expand to the southern part of the state before mid-1984. Customers can pay bills by transferring funds from their accounts to some two hundred merchants, utilities, and other creditors that will be linked to the service. For a monthly fee of $8, customers can use the service between 6 a.m. and midnight, seven days a week. Citing estimates that some seven hundred thousand California households will have personal computers by 1984—and that about 20 percent of those will have modems—the bank hopes to have twenty-five thousand of its customers using electronic banking by the end of 1984.

∆**Snooper Troops.** More than 15 percent of American households own a microcomputer or have at least one member using a micro at work or school, according to a survey by Mountain View, California-based Microcomputer Research Group. Company officials attribute the higher-than-expected exposure figures to the fact that micros are shared by an average of three users at work and many times that number at school. The survey, which included two thousand U.S. households, found that "lack of need" and a resistance to "high prices" were the most common reasons respondents gave for not purchasing a microcomputer. However, children's needs figure heavily in a possible future change in attitude. In terms of software, the survey responses indicate that the typical home user expects to buy two productivity packages during the next twelve months, with word processing and filing programs being the top choices. About 75 percent of the home users expect to buy business packages, as compared with two-thirds who expect to buy education software. The survey also disclosed that the software aftermarket exceeds the demand for software purchased at the time the hardware is purchased.

∆ **Hostiles on the Horizon.** The Robotics and Remote Handling in Hostile Environments meeting will be held April 23—26 at the Sheraton Hotel in Gatlinburg, Tennessee. Sponsored by the American Nuclear Society's Remote Systems Technology Division (ANS/RSTD) and the Oak Ridge/Knoxville ANS Section, the meeting will focus on the use of robotics in nuclear power plants and other hostile environments. For further information, contact the show's technical program chairman in Oak Ridge, Tennessee.

∆ **Future Factory.** Late last year, the National Bureau of Standards (NBS) publicly displayed its $5-million experimental Automated Manufacturing Research Facility in Gaithersburg, Maryland. The facility links computer-controlled robots and tools, no two of which come from the same makers, into a working system. The ongoing project was established to provide standards for the rapidly evolving robotics industry, and to project what the factory of the future will be like. The initial phase of the project showed that custom software allows different equipment from a variety of manufacturers to communicate with and control one another—without, for example, requiring a common programming language or revealing trade secrets about how a particular machine works. Software developments such as this could benefit companies that manufacture small batches of parts by enabling them to acquire new machinery one piece at a time without facing a compatibility problem. Currently, only the largest mass producers can afford a flexible manufacturing system of this kind. Digital/Analog Design Associates (New York, NY) has been awarded a contract to deliver its Pipelined Image Processing Engine (PIPE) to the NBS facility. PIPE was designed specifically for robotics applications and is capable of performing nearly one billion integer multiplications per second. It combines an innovative architecture with multiple high-speed processing units to perform a series of complex image processing functions, called scene analysis, in real time. Digital/Analog says PIPE is 30 to 100 times as fast as other available robot vision systems. The company plans to market PIPE later this year. ▲

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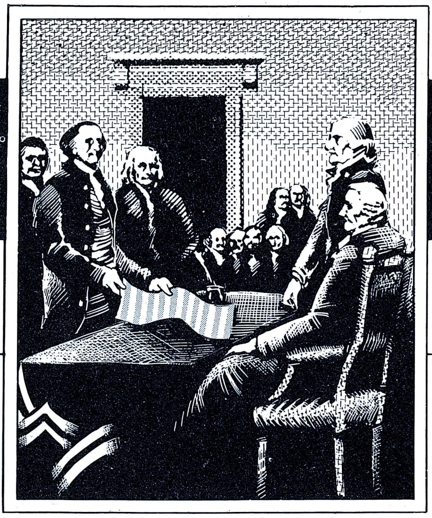

Volume Labels

One of the features that version 2.0 added to PC-DOS was support for something called a *volume label*. Many users making the transition from version 1 to version 2 are confused by this feature and wonder what it's good for. This month's column discusses the concept of volumes, explains how labels are implemented, and presents a small utility that lets you display or modify your volume labels.

A volume is a logically self-sufficient (and usually removable) unit of storage. It contains one or more complete files and a directory describing those files. For example, a single floppy disk or removable disk cartridge is a volume; for these devices, a logical volume corresponds to a physical volume. Hard disks that aren't removable are often partitioned into several logical volumes.

On large computer systems each removable volume of storage will have a name or "label" assigned to it at the time the volume is initialized; the label is implicitly assumed to be unique. By looking at this identifier, the computer's operating system can tell when one disk mounted in the disk drive has been exchanged for another. Other information—such as the time and date the volume was initialized, its capacity and format type, and the read/write access privileges for various users or classes of users—is frequently associated with the volume label.

Under DOS 2.0, this capability has been brought (in part) down into a microcomputer operating system. Whenever we format a disk, we now have the option of assigning a name to it by means of the */V* switch. This label can be up to eleven characters in length and can consist of anything from a serial number to a name that's descriptive of the disk's contents. The *vol, tree, dir,* and *chkdsk* commands all display the label for a given disk.

What's this worth to us? Under DOS 2.0, sadly enough, not much. True, volume labels give us a way to identify a disk and see what it contains (or should contain)—but a hand-written sticker on the floppy disk already does that. DOS 2.0 doesn't use the labels internally to provide any kind of security for our data files. We aren't even given any convenient way to modify a label once it's been assigned or to add a label to a disk that already has files on it.

For the present, then, use of volume labels is clearly optional. Nevertheless it's a good idea to get familiar with the concept, because it's widely used on larger computer systems and may turn out to be more crucial in future releases of PC-DOS.

The Implementation of Labels. On many computer systems, the volume label and associated information is written in a special reserved disk sector. The programmers responsible for DOS 2.0, however, had to find a way to add this feature under some constraints. They had to preserve upward compatibility with DOS 1.1, abiding by a disk allocation scheme that was already fairly strictly defined.

The solution they found was straightforward. The volume identifier is simply stored in the root directory of the disk, its form closely resembling that of an entry for an empty file. The only difference, in fact, between a label

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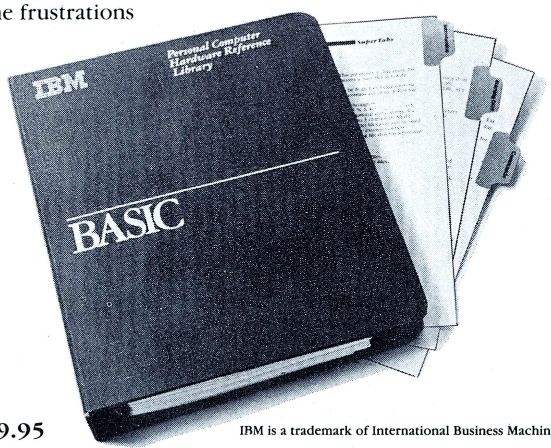

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entry and an entry for an empty file is a flag in the "attribute byte"; this flag works similarly to the flags that mark a file as *system, hidden,* or *read-only.* This method has helpful consequences: The standard DOS functions for finding or modifying filenames can be used (with minor changes in technique) to read or change the volume name. (We may note in passing that the names and pointers for subdirectories are stored in the directory in a very similar fashion.)

The LABEL Utility. The program for this month's column, called LABEL, is significantly more complex than the ones published in previous months. It employs a data structure called a *file control block* and a new class of DOS function calls to access the disk directory. Both file control blocks and file access methods will be discussed in great detail in the upcoming columns; if you want to know more now, read Appendix C of the DOS 2.0 manual.

LABEL allows you either to display the name of a selected disk (just as the *vol* command does) or to give the volume a new name. You can do this at any time, and you won't affect those files that are already on the disk.

To show the name of a disk, just enter:

LABEL [unit:] ⟨return⟩

The disk unit specifier is optional but must be followed by a colon if present; if no drive is specified, the current (default) drive is assumed.

For example, to see the volume name assigned to the floppy disk in drive B, type:

LABEL B: ⟨return⟩

To change the label on a disk, enter:

LABEL unit:name

Again, the unit is optional. The default drive is assumed if no unit is specified.

To assign the name *MYDISK1* to the floppy disk in drive B, type:

LABEL B:MYDISK1

This program occupies only 1,280 bytes on your disk. Compare that to the 8,067 bytes consumed by a popular utility on the market that serves the same function and you have further evidence of the superiority of assembly language for writing systems tools (over the presently available compilers, at least).

But a word of warning: *Please* be careful when keying in and installing this program. It uses powerful DOS functions and modifies a sensitive area of the disk. *Check* your assembly listing byte by byte against the listing published here, and make sure the object code is exactly the same. Then *test* the program on an expendable floppy disk—*not* on the floppy containing your payroll files or your only copy of *Super-Mega-Starwars.*

How LABEL Works. First, the utility makes sure that it's being run under DOS version 2.0 or greater. This is necessary because earlier versions would not recognize the volume flag in the extended file control block's attribute byte.

Next, LABEL inspects the command tail passed to it by DOS in the "default buffer" (offset 80H in the Program Segment Prefix). If no command tail is present, or if only a disk unit was entered, the program merely searches for the volume label on the selected or default drive, displays it for the user, and exits.

If the user has specified a new name in the command tail, LABEL first finds and displays the previously existing label (if any). If the disk is unnamed, LABEL uses the DOS function 16H (*create file*) to establish a new directory entry with the special volume attribute byte.

If the selected disk already has a name, the utility instead uses the *rename* function (17H) to modify the existing label.

Finally, the updated volume label is displayed, and the program returns control to the operating system.

You may notice that although the utility is called LABEL, we use the name *labl* in the source code for its chief procedure. This is because *label* is a reserved keyword of the *Macro Assembler* and can't be used as an ordinary symbol name. You can still call the source and executable files LABEL.ASM and LABEL.EXE respectively, though, without causing the as-

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sembler any problems.

Our program contains only three significant subroutines this month in addition to the main-line code. Unfortunately, two of them are quite specialized and won't be of much use in other programs you may write.

PRINT_VOL is passed an address, which it uses to display an eleven-byte volume name on the console. Blanks are thrown away and lowercase letters are folded to uppercase.

VOL_NAME examines the command line tail passed to LABEL by DOS to see if the user has entered a drive and/or volume label. If no drive has been entered, DOS function 19H is called to obtain the identity of the default drive. If a new volume label is present in the command tail, the label is copied into a special extended file control block for later use. This routine looks complicated because it must extract the prospective label directly from the raw input. DOS does kindly parse the name out for us and places it in the default file control block at offset 5CH in the Program Segment Prefix—but as a filename that has been truncated to eight characters.

SHOW_LABEL first sets the "disk transfer address" to point to a 128-byte scratch buffer by calling DOS function 1AH. Next, it uses an extended file control block with a wildcard filename and a volume attribute byte to search for any existing label on the selected floppy disk. If no label is found, SHOW_LABEL prints an advisory message; if a label is present, PRINT_VOL is called to display it. Finally, register AX is set up as a flag to be returned to the main program, indicating the presence or absence of a previous label.

In the process of writing this program, I discovered a vicious bug in PC-DOS. In the case where a new name was to be given to a floppy disk that already had a label, my first approach was simply to delete the old entry (using function 13H), then create a new one (with function 16H). Alas, DOS gets confused when one deletes a directory entry with the volume attribute turned on, and it wreaks havoc on the vital File Allocation Table for that floppy disk. This is strange, since it certainly can handle deletion of an empty file—which is essentially the same task.

Another interesting discovery was that you can't use the new Unix-like file-access functions to construct a volume identifier. From reading the documentation, it seemed quite reasonable to establish the directory entry with the enhanced *create* function (3CH), then change its attribute byte to contain the volume flag with the *chmod* function (43H). However, the latter call fails with an "access denied" error code, so it looks like we're stuck with the old file control block methods for now.

Painless Access to Source Code. Don Watkins, one of the SysOps for the IBM PC Special Interest Group area on CompuServe, has kindly uploaded the source files for all programs previously published in this column into the "Programming" database. Readers who subscribe to CompuServe can use almost any communications program with file-capture capability to download the source code, thereby saving themselves a great deal of typing. Enter *go pcs-131* at the first ! prompt, then *xa 4*. We will try to have the source for each future program on-line by the magazine's cover date. Thanks, Don! ▲

```
                                          name        labl
                                          page        55,132
                                          title       'LABEL —- display or change volume label'
                            ;
                            ; LABEL —- display or change volume label
                            ;
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 = 000D                     cr            equ         0dh             ;ASCII carriage return
 = 000A                     lf            equ         0ah             ;ASCII line feed
 = 0024                     eom           equ         '$'             ;end of message flag

                                                                      ;Program Segment Prefix:
 = 0080                     command       equ         80h             ;command line buffer
 = 005C                     default_fcb   equ         05ch            ;default file control block

 = 0001                     rd_only       equ         01h             ;file attributes
 = 0002                     hidden        equ         02h
 = 0004                     system        equ         04h
 = 0008                     volume        equ         08h
 = 0010                     subdir        equ         10h
 = 0020                     archive       equ         20h


0000                        cseg          segment     para public 'CODE'

                                          assume      cs:cseg,ds:data,es:data,ss:stack

0000                        labl          proc        far             ;entry point from PC-DOS

0000    1E                                push        ds              ;save DS:0000 for final
0001    33 C0                             xor         ax,ax           ;return to PC-DOS
0003    50                                push        ax
0004    B4 30                             mov         ah,48           ;make sure this is DOS
0006    CD 21                             int         21h             ;version 2.0 or greater
0008    3C 02                             cmp         al,2
000A    73 0D                             jae         labl1           ;version is ok, jump
000C    B8 — R                            mov         ax,data
000F    8E D8                             mov         ds,ax
0011    BA 0179 R                         mov         dx,offset msg6  ;version too low, print error
0014    B4 09                             mov         ah,9            ;message and exit
0016    CD 21                             int         21h
0018    CB                                ret
0019    B8 — R              labl1:        mov         ax,data         ;make our data segment addressable
001C    8E C0                             mov         es,ax           ;via the ES register
001E    E8 00BD R                         call        vol_name        ;get name for new volume label
                                                                      ;if any was given by user
0021    8C C0                             mov         ax,es           ;now set DS=ES for remainder
0023    8E D8                             mov         ds,ax           ;of the program.
0025    E8 006A R                         call        show_label      ;display the current volume label
                                                                      ;on the selected diskette. subroutine
                                                                      ;returns AX=0 if no label on
                                                                      ;disk, AX=-1 if label exists.
                                                                      ;was new label supplied by user?
0028    80 3E 0008 R 20                   cmp         byte ptr fcb+1,' '
002D    75 01                             jne         labl2           ;yes,change or add volume label
002F    CB                                ret                         ;no, display only, exit to PC-DOS

0030                        labl2:                                    ;new name supplied by user.
0030    0B C0                             or          ax,ax           ;was previous label present?
                                                                      ;(flag in AX from SHOW_LABEL)
0032    74 15                             jz          labl3           ;no,jump
0034    B9 000B                           mov         cx,11           ;yes,change it
0037    BF 0070 R                         mov         di,offset buffer+24
003A    BE 0008 R                         mov         si,offset fcb+1 ;set up new name starting at
003D    F3/ A4                            rep movsb                   ; 6 bytes after old name
003F    BA 0058 R                         mov         dx,offset buffer
0042    B4 17                             mov         ah,23           ;request alteration of volume name
0044    CD 21                             int         21h             ;by PC-DOS function 23=RENAME
0046    EB 08 90                          jmp         labl4           ;go check if function was successful,
                                                                      ;if it was display new volume name.

0049                        labl3:                                    ;come here to add new label, if
                                                                      ;diskette previously had no label.
0049    BA 0000 R                         mov         dx,offset xfcb  ;DX=addr of extended fcb
                                                                      ;containing "volume" attribute byte.
004C    B4 16                             mov         ah,22           ;Use PC-DOS function 22 to create
004E    CD 21                             int         21h             ;a new directory entry.
0050    3C FF               labl4:        cmp         al,0ffh         ;was function successful?
0052    75 08                             jne         labl5           ;yes,jump to display new name.
0054    BA 00DB R                         mov         dx,offset msg2  ;no,print error message
0057    B4 09                             mov         ah,9            ;and exit
0059    CD 21                             int         21h
005B    CB                                ret

005C                        labl5:                                    ;label successfully created.
005C    BA 0105 R                         mov         dx,offset msg3  ;print first part of message.
005F    B4 09                             mov         ah,9
0061    CD 21                             int         21h
0063    BB 0008 R                         mov         bx,offset fcb+1;print actual volume name
0066    E8 0097 R                         call        print_vol       ;in uppercase.
0069    CB                                ret                         ;exit to PC-DOS.
006A                        labl          endp


006A                        show_label proc near                      ;Display the label for the
                                                                      ;disk in the selected drive and
                                                                      ;return AX=-1, or display message
                                                                      ;and return AX=0 if no label exists.
006A    BA 0058 R                         mov         dx,offset buffer
006D    B4 1A                             mov         ah,26           ;set disk transfer address
006F    CD 21                             int         21h             ;for use in directory search
0071    BA 002C R                         mov         dx,offset sfcb  ;now look for the first directory
                                                                      ;entry with "volume" attribute,
0074    B4 11                             mov         ah,17           ;using PC-DOS function 17
0076    CD 21                             int         21h             ;"search for first matching filename"
0078    3C FF                             cmp         al,0ffh         ;any volume label found?
007A    74 11                             je          show_label2     ;no,jump
007C    BA 0136 R                         mov         dx,offset msg4  ;yes print message and
007F    B4 09                             mov         ah,9            ;volume name
0081    CD 21                             int         21h
0083    BB 0060 R                         mov         bx,offset buffer+8
0086    E8 0097 R                         call        print_vol
0089    B8 FFFF                           mov         ax,-1           ;return AX=-1, label exists
008C    C3                                ret
008D                        show_label2:                              ;disk was not labeled,
008D    BA 0156 R                         mov         dx,offset msg5  ;so print message and
0090    B4 09                             mov         ah,9            ;return AX=0 as signal that
0092    CD 21                             int         21h             ;there is no previous label
0094    33 C0                             xor         ax,ax
0096    C3                                ret
0097                        show_label endp


0097                        print_vol proc            near            ;print the volume name
                                                                      ;whose offset is in BX on
                                                                      ;the standard output device.
                                                                      ;Regs AX, BX, DX destroyed.
0097    B9 000B                           mov         cx,11           ;name is max of 11 characters
009A                        pvol2:
009A    8A 17                             mov         dl,[bx]         ;get next char from string
009C    80 FA 20                          cmp         dl,' '
009F    74 11                             je          pvol4
00A1    80 FA 61                          cmp         dl,'a'          ;if it is a lowercase alpha
```

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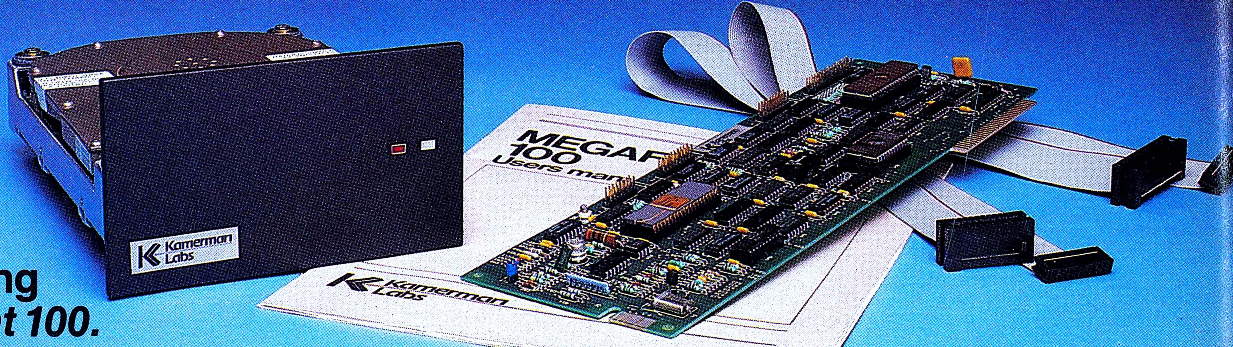

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```
00A4    72 08                         jb          pvol3             ;character, fold to uppercase
00A6    80 FA 7A                      cmp         dl,'z'
00A9    77 03                         ja          pvol3
00AB    80 F2 20                      xor         dl,20h
00AE                    pvol3:
00AE     B4 02                        mov         ah,2              ;function 2=output char.
00B0    CD 21                         int         21h               ;request output by PC-DOS
00B2    43              pvol4:        inc         bx                ;advance to next string position
00B3    E2 E5                         loop        pvol2             ;until 11 chars. processed.
00B5                    pvol9:                                      ;done with string output,
00B5    BA 00D8 R                     mov         dx,offset msg1 ;send final carriage return
00B8    B4 09                         mov         ah,9              ;and line feed,
00BA    CD 21           int           21h
00BC    C3                            ret                           ;then return to caller
00BD                    print_vol endp

00BD                    vol_name      proc        near              ;Transfer the new volume name
                                                                    ;from the Program Segment Prefix
                                                                    ;into the local File Control Block

                                                                    ;let DS:SI=command tail address
00BD    BE 0080                       mov         si,offset command
00C0    AC                            lodsb                         ;check string length byte,
00C1    0A C0                         or          al,al             ;any name present?
00C3    74 29                         jz          vol_name4         ;no,go get drive
00C5                    vol_name1:                                  ;scan for start of name
00C5    AC                            lodsb                         ;get next char
00C6    3C 0D                         cmp         al,cr             ;if carriage return,name is missing
00C8    74 24                         je          vol_name4         ;so jump to get drive
00CA    3C 20                         cmp         al,' '            ;if blank, keep looking
00CC    74 F7                         je          vol_name1
                                                                    ;now found none-blank char
                                                                    ;let ES:DI = addr of name field
00CE    BF 0008 R                     mov         di,offset fcb+1 ;in local file control block
00D1    B9 000B                       mov         cx,11             ;CX will be counter, 11 chars max.
                                                                    ;did DOS's parser find legal drive?
00D4    8A 26 005C                    mov         ah,ds:default_fcb
00D8    0A E4                         or          ah,ah
00DA    74 0A                         jz          vol_name2         ;no,jump.
00DC    AC                            lodsb                         ;yes,then next char ought to
00DD    3C 3A                         cmp         al,':'            ;be a colon.
00DF    75 0D                         jne         vol_name4         ;not colon, some kind of error.
00E1    AC                            lodsb                         ;fetch next character after colon.
00E2    3C 20                         cmp         al,' '            ;make sure name is also there.
00E4    76 08                         jna         vol_name4         ;no name,jump to get drive.
00E6                    vol_name2:                                  ;now we transfer bytes from
                                                                    ;command tail into the fcb
                                                                    ;for the new volume name.
00E6    AA                            stosb
00E7    AC                            lodsb                         ;check next char from input.
00E8    3C 20                         cmp         al,' '            ;if blank or any control char
00EA    76 02                         jna         vol_name4         ;found end of name.
00EC    E2 F8                         loop        vol_name2         ;otherwise, keep looking until
                                                                    ;11 characters have been processed.
00EE                    vol_name4:
00EE    A0 005C                       mov         al,ds:default_fcb
00F1    0A C0                         or          al,al             ;was disk drive specified?
00F3    75 06                         jnz         vol_name5         ;yes,use it.
00F5    B4 19                         mov         ah,25             ;no, get identity of default drive.
00F7    CD 21                         int         21h
00F9    FE C0                         inc         al
00FB                    vol_name5:                                  ;put drive into file control blocks
00FB    26: A2 0007 R                 mov         es:fcb,al         ;for search and new volume name.
00FF    26: A2 0033 R                 mov         es:sfcb+7,al
0103    04 60                         add         al,'a'-1          ;also form ASCII letter for
0105    26: A2 00FF R                 mov         es:msg2a,al       ;drive, and put into
0109    26: A2 011E R                 mov         es:msg3a,al       ;output messages.
010D    26: A2 014F R                 mov         es:msg4a,al
0111    26: A2 0166 R                 mov         es:msg5a,al
0115    C3                            ret
0116                    vol_name endp

0116                    cseg          ends


                                                                    ;data segment for
                                                                    ;miscellaneous messages,
                                                                    ;constants, and variables
0000                    data          segment para public 'DATA'
                                                                    ;extended file control block
0000    FF              xfcb          db          0ffh              ;flag for special fcb
0001       05 [                       db          5 dup (0)         ;reserved
                 00
                       ]

0006    08                            db          volume            ;volume label attribute byte
                                                                    ;remainder is "normal" fcb
0007    00              fcb           db          0                 ;drive (set by VOL_NAME)
0008      0B [                        db          11 dup (' ')      ;blank name field
               20
                       ]

0013    19 [                          db          25 dup (0)
                 00
                       ]


002C    FF              sfcb          db          0ffh              ;extended file control block used
002D       05 [                       db          5 dup (0)         ;to search for current label
                  00
                       ]

0032    08                            db          volume
0033    00                            db          0                 ;drive (set by VOL_NAME)
0034    0B    [                       db          11 dup ('?')      ;wildcard name
                 3F
                       ]

003F    19 [                          db          25 dup (0)
                00
                       ]


0058      80 [          buffer        db          128 dup (?)       ;buffer for disk directory search
              ??
                       ]


00D8    0D 0A 24              msg1          db          cr,lf,eom

00DB    0D 0A                 msg2          db          cr,lf
00DD    55 6E 61 62 6C 65                   db          'Unable to write new label on disk '
        20 74 6F 20 77 72
        69 74 65 20 6E 65
        77 20 6C 61 62 65
        6C 20 6F 6E 20 64
        69 73 6B 20
00FF    78 3A 20 0D 0A 24     msg2a         db          'x: ',cr,lf,eom

0105    0D 0A                 msg3          db          cr,lf
0107    4C 61 62 65 6C 20                   db          'Label of disk in drive '
        6F 66 20 64 69 73
        6B 20 69 6E 20 64
        72 69 76 65 20
011E    78 3A 20 68 61 73     msg3a         db          'x: has been changed to ',eom
        20 62 65 65 6E 20
        63 68 61 6E 67 65
        64 20 74 6F 20 24

0136    0D 0A 4C 61 62 65     msg4          db          cr,lf,'Label of disk in drive '
        6C 20 6F 66 20 64
        69 73 6B 20 69 6E
        20 64 72 69 76 65
        20
014F    78 3A 20 69 73 20     msg4a         db          'x: is ',eom
        24

0156    0D 0A 44 69 73 6B     msg5          db          cr,lf,'Disk in drive '
        20 69 6E 20 64 72
        69 76 65 20
0166    78 3A 20 68 61 73     msg5a         db          'x: has no label.',cr,lf,eom
        20 6E 6F 20 6C 61
        62 65 6C 2E 0D 0A
        24

0179    0D 0A                 msg6          db          cr,lf
017B    4C 41 42 45 4C 20                   db          'LABEL program requires DOS '
        70 72 6F 67 72 61
        6D 20 72 65 71 75
        69 72 65 73 20 44
        4F 53 20
0196    76 65 72 73 69 6F                   db          'version 2.0 or greater.'
        6E 20 32 2E 30 20
        6F 72 20 67 72 65
        61 74 65 72 2E
0/1AD   0D 0A 24                            db          cr,lf,eom

01B0                          data          ends


0000                          stack         segment     para stack 'STACK'
0000          40 [                          db          64 dup (?)
                    ??
                       ]

0040                          stack         ends

                                            end         labl
```

```
Segments and groups:
            N a m e              Size     align     combine     class
CSEG .....................0116     PARA      PUBLIC      'CODE'
DATA .....................01B0     PARA      PUBLIC      'DATA'
STACK ....................0040     PARA      STACK       'STACK'

Symbols:
            N a m e              Type      Value     Attr
ARCHIVE ..................Number    0020
BUFFER ...................L BYTE    0058      DATA        Length =0080
COMMAND ..................Number    0080
CR .......................Number    000D
DEFAULT_FCB ..............Number    005C
EOM ......................Number    0024
FCB ......................L BYTE    0007      DATA
HIDDEN ...................Number    0002
LABL .....................F PROC    0000      CSEG        Length =006A
LABL1 ....................L NEAR    0019      CSEG
LABL2 ....................L NEAR    0030      CSEG
LABL3 ....................L NEAR    0049      CSEG
LABL4 ....................L NEAR    0050      CSEG
LABL5 ....................L NEAR    005C      CSEG
LF .......................Number    000A
MSG1 .....................L BYTE    00D8      DATA
MSG2 .....................L BYTE    00DB      DATA
MSG2A ....................L BYTE    00FF      DATA
MSG3 .....................L BYTE    0105      DATA
MSG3A ....................L BYTE    011E      DATA
MSG4 .....................L BYTE    0136      DATA
MSG4A ....................L BYTE    014F      DATA
MSG5 .....................L BYTE    0156      DATA
MSG5A ....................L BYTE    0166      DATA
MSG6 .....................L BYTE    0179      DATA
PRINT_VOL ................N PROC    0097      CSEG        Length =0026
PVOL2 ....................L NEAR    009A      CSEG
PVOL3 ....................L NEAR    00AE      CSEG
PVOL4 ....................L NEAR    00B2      CSEG
PVOL9 ....................L NEAR    00B5      CSEG
RD_ONLY ..................Number    0001
SFCB .....................L BYTE    002C      DATA
SHOW_LABEL ...............N PROC    006A      CSEG        Length =002D
SHOW_LABEL2 ..............L NEAR    008D      CSEG
SUBDIR ...................Number    0010
SYSTEM ...................Number    0004
VOLUME ...................Number    0008
VOL_NAME .................N PROC    00BD      CSEG        Length =0059
VOL_NAME1 ................L NEAR    00C5      CSEG
VOL_NAME2 ................L NEAR    00E6      CSEG
VOL_NAME4 ................L NEAR    00EE      CSEG
VOL_NAME5 ................L NEAR    00FB      CSEG
XFCB .....................L BYTE    0000      DATA

Warning     Severe
Errors      Errors
0           0
```

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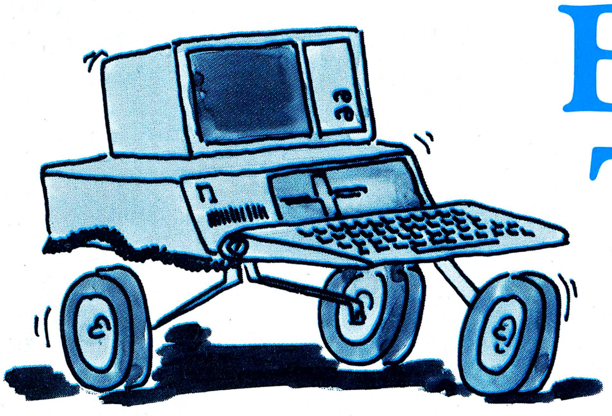

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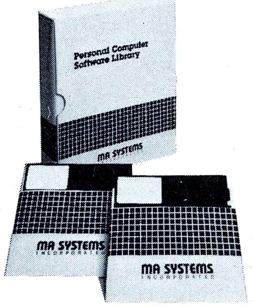

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The new year is bringing changes—both welcome and unwelcome, depending on your perspective—to the IBM Personal Computer market. The happiest note might be IBM's recent announcement of a clustering product that allows several PCs to be linked for sharing of resources. IBM's announcement carefully avoided calling the product a network, which might imply yet another product that will enable the PC to communicate with different computers.

The cluster appears designed only to link members of the PC family—PC, XT, *jr*, and the new portable PC—to each other. That's significant progress in harnessing the power of the PC and apparently lacks only the ability to communicate outside the family. IBM says the software, licenses, and cabling for a typical five-unit cluster will run about $2,500—a reasonable price for the added functionality.

In the same announcement with the cluster was the news of the IBM portable. Coming standard with 256K, one drive, a graphics adapter, and five expansion slots, the machine looks like a bargain at $2,795. The only quibble might be over the term *portable*. At thirty pounds, the machine is more movable than portable.

The third-party software market has been moving in the direction of recognizing networked or linked PCs as well. The latest to jump on the bandwagon was Ashton-Tate, publisher of the popular *dBase II*. Whether the *dBase* networking enhancement functions in the IBM cluster mode was unclear, but harnessing the power of the package over several microcomputer systems is a forward step in functionality.

The last piece of good news from the third-party side of the market was the announcement from Lotus Development of *Symphony*. *Symphony* is a superset of *1-2-3*, the program that's driven the PC software market for the last year. Availability is projected for early summer, with owners of *1-2-3* having the privilege of upgrading for the difference in the cost of the two packages.

Symphony features communications, enhanced word processing, and expanded database functions. The program is priced at $695 and puts Lotus's challengers back in the position of having to reevaluate their products and perhaps play catch-up.

The old guard suffered the most during the early part of the year. *VisiCalc*, the program that validated the whole microcomputer industry, has become the object of squabbling among its progenitors. Last fall, publisher VisiCorp filed a lawsuit against author Software Arts, asking for $60 million in real and punitive damages because Software Arts had not delivered *VisiCalc* enhancements and new products in a timely fashion.

Software Arts has now countersued VisiCorp, seeking possession of the product on the basis that VisiCorp has violated its contract by not using its best efforts to sell *VisiCalc*. At last glance, VisiCorp has gone back to court to enjoin Software Arts from producing the product for sale and failed.

The other former software standard, *WordStar*, also seems to have fallen on hard times. The results of January sales, herein reported, show that three word processing programs outperformed *WordStar*.

The biggest impetus to the drop appeared to be *Word*, from Microsoft, which jumped from thirtieth to eighth on the list. *MulitiMate*, which has been stalking *WordStar* for months, was the bestselling word processor and the sixth bestselling product overall. *PFS:Write* scored a ninth-place finish. That left *WordStar* with nowhere to go but down. Down in this case was thirteenth.

MultiMate scores heavily among the PC corporate crowd because of its resemblance to Wang word processors. *Word* and *PFS:Write* were able to hit the market running because the publishers, Microsoft and Software Publishing Corporation, have good distribution channels and other widely respected products.

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Contrast those programs with *WordPerfect*, thirtieth this month, and *EasyWriter II*, which was just outside the Top Thirty at thirty-first. Satellite Software International and Information Unlimited Software lack the strong distribution networks of Microsoft or Software Publishing Corporation and/or the instant product recognition that was a part of Softword Systems's success with *MultiMate*.

A quick look at per-store unit volumes and store penetration percentages tells the tale. *WordStar* was reported by 74 percent of the stores polled, but averaged only 3 units per store. *Word* had the second strongest market penetration with 65 percent of the stores reporting sales of the program. The stores averaged 4.4 units.

MultiMate was in 58 percent of the stores, but each store sold 5.9 units, the highest average of any word processor. *PFS:Write* was sold in 55 percent of the outlets at an average of 5.1 units per store.

WordPerfect had a high unit average, 5.0, but was reported by only 13 percent of the retail stores. *EasyWriter II* had stronger distribution, being in 32 percent of the stores, but sold only 1.6 units per store.

The numbers show that *MultiMate*'s recognition factor has carried it into the lead while other new programs have benefited from strong distribution. The fact that these six programs account cumulatively for 297 percent of the stores polled indicates the intense competition that exists for shelf space and buyer attention. ▲

IBM-franchised retail stores representing approximately 4.79 percent of all sales of IBM and IBM-related products volunteered to participate in the poll.

Respondents were contacted early in February to ascertain their sales for the month of January.

The only criterion for inclusion on the list was the number of units sold; such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in February respresented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

Probability of statistical error is plus or minus 3.41 percent, which translates roughly into the theoretical possibility of a change of 3.79 points, plus or minus, in any index number.

the top thirty

This Month	Last Month	Index	
1	1	225.21	**1-2-3**, Mitch Kapor and Jonathan Sachs; Lotus Development
2	2	98.97	**Microsoft Flight Simulator**, Bruce Artwick; Microsoft
3	5	72.30	**PFS:File**, John Page and D.D. Roberts; Software Publishing Corporation
4	6	66.97	**dBase II**, Wayne Ratliff; Ashton-Tate
5	26	66.38	**PC Tutor**, Lora Meise and Rick Lane; Comprehensive Software Support
6	11	63.41	**MultiMate**; Softword System
7	13	58.08	**Multiplan**; Microsoft
8	30	52.15	**Word**; Microsoft
9	10	51.56	**PFS:Write**; Sam Edwards, Brad Crain, and Ed Mitchell; Software Publishing Corporation
10	3	48.59	**MasterType**, Bruce Zweig/Lightning Software; Scarborough Systems
11	25	47.41	**Crosstalk**; Microstuf
12	16	45.04	**PFS:Report**, John Page; Software Publishing Corporation
13	4	40.89	**WordStar**; MicroPro
14	12	33.19	**Home Accountant Plus**, Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Continental Software
15	22	31.41	**PFS:Graph**, Bessie Chin and Stephen Hill; Software Publishing Corporation
16	21	27.85	**Norton Utilities**, Peter Norton; Peter Norton Inc.
17	18	24.89	**Typing Tutor**, Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)
18	17	23.69	**VisiCalc**, Software Arts/Dan Bricklin and Robert Frankston; VisiCorp, IBM
19	—	23.10	**Copy II Plus**; Central Point Software
20	27	22.51	**SuperCalc2**; Sorcim
21	19	21.92	**Basic Compiler**, Microsoft; IBM
22	20	21.33	**Macro Assembler**, Microsoft; IBM
	7	21.33	**Zork I**; Infocom
24	8	17.78	**Zork III**; Infocom
25	9	17.18	**Zork II**; Infocom
26	28	15.40	**ProKey**, David Rose; Rosesoft
27	15	14.81	**Cdex Training for the IBM PC**, Rohit Patel; Cdex Corporation
28	28	12.44	**General Ledger**, John Moss and Ken Debower; IBM (BPI)
29	—	11.85	**Managing Your Business with the Lotus 1-2-3 Program**, Dr. Steve Brandt; Cdex Corporation
30	14	11.26	**WordPerfect**, Alan Ashton and Bruce Bastian; Satellite Software

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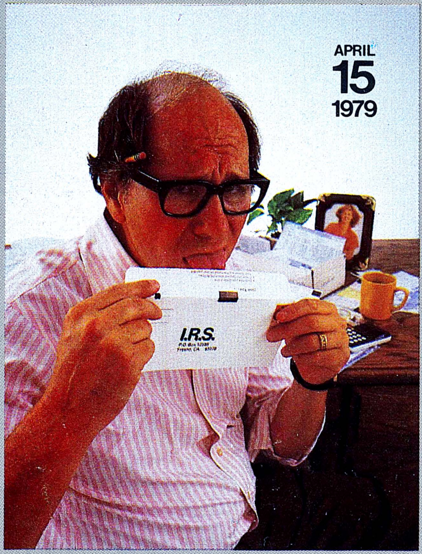

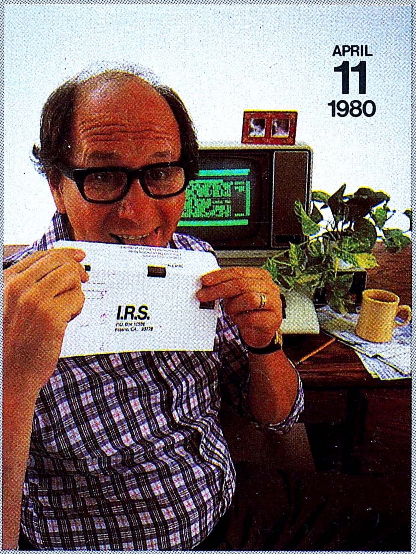

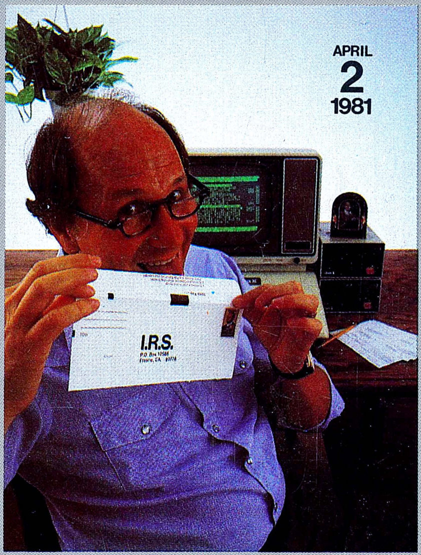

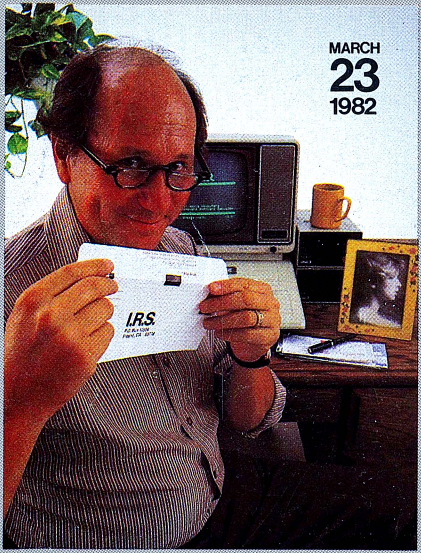

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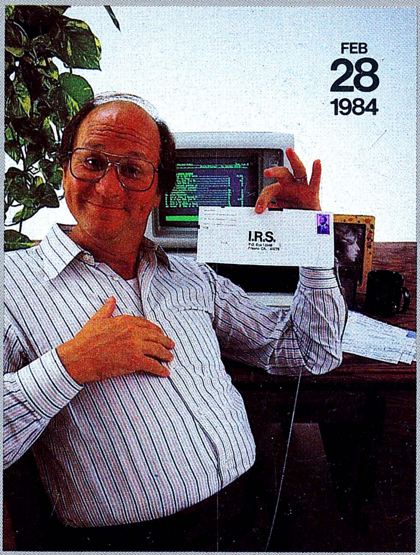

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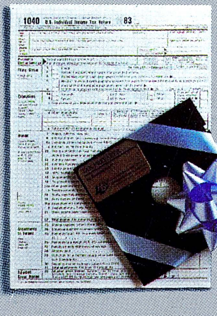

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